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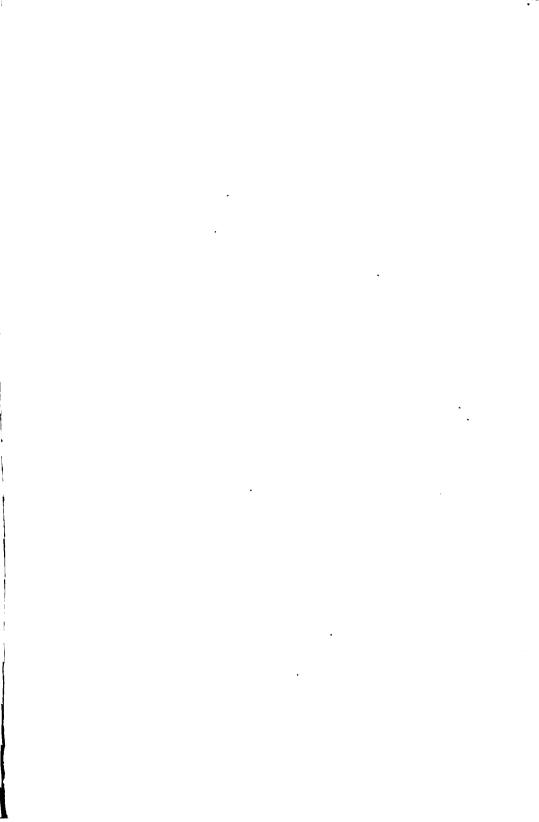
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JOURNAL

OF THE

ASIATIC SOCIETY OF BENGAL.

VOL. XLIX.

PART I. (HISTORY, ANTIQUITIES, &c.)

(Nos. I to IV.—1880: with 22 Plates and 2 Maps.)

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THE PHILOLOGICAL SECRETARY.

"It will flourish, if naturalists, chemists, antiquaries, philologers, and men of science in different parts of Asia, will commit their observations to writing, and send them to the Asiatic Society at Calcutta. It will languish, if such communications shall be long intermitted; and it will die away, if they shall entirely cease." SIR WM. JONES.

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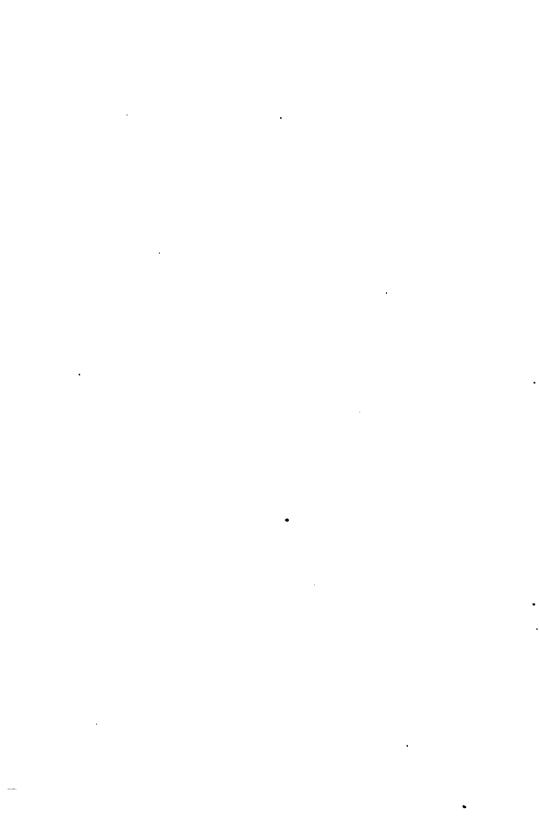
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JOURNAL

OF THE

ASIATIC SOCIETY OF BENGAL.

Part I.—HISTORY, LITERATURE, 46.

No. I.—1880.

Description of the Great Siva Temple of Gangai Kondendram and of some other places in the Trichinopoli District.—

By LIEUT.-COL. B. R. BRANFILL. (With a Plate.)

During the past season I visited and examined the great Siva temple of Gangaikonda (-Shola-)puram (Gangacondapuram of A. S. 79), situate in the extreme E. N. E. part of the Trichinopoly District, 20 miles S. W. from Chidambaram.

As this is the largest* and best specimen of a South Indian temple proper I have ever met with, I venture to offer a short description of it. Roughly speaking it is a facsimile of the great Tanjore Temple, possibly its prototype, or perhaps more probably a copy; but never having been "restored," as the Tanjore example has, and being built throughout in a very hard kind of stone, it retains much of its pristine appearance and purity of design, which has been lost there.

I made notes of my observations on the spot and took measurements, sketches and some impressions of the inscriptions with which its base is covered, as specimens of the character, which is mostly old Tamil, very similar to that at Tanjore.

Gangaikondapuram is the site of a deserted town supposed to have been the city or chief town of Gangaikonda Chóla.

• The largest Indian sanctuary towers mentioned by Fergusson (Hist. of Arch. Vol. III.) are those of Jaganáth at Puri and the great Tanjore Pagoda, which are 80 and 82 feet square at base respectively.

Most of the inscriptions appeared to be mere statements of gifts made to the temple by private persons. The western and southern (side) inscriptions appeared to be mostly in the Tamil character and language with occasional Sanskrit formulæ to begin and end with. Those on the northern side were said to be chiefly in Grantha and Telugu or other (than Tamil) characters.

The temple consists of a grand stone "stubi" (as they called it), a sanctuary steeple or Vimánam on a raised basement or terrace, decorated by a rail ornament below, having the upright posts engraved with griffins (or Yáli), and an elaborate scroll-enveloped animal or figure on every third or fourth post, but no cross-bars or horizontal rails between.

The Alódai or terrace-path is 3½ feet wide, surrounding the entire temple, including the great Veli-mandapam or Outer court, at a height of about 5 feet above the (original) ground level.

The great pyramidal Vimana is 100 feet square* at base and about 165 feet high. The double story below the pyramid and immediately above the terrace basement is vertical, with five compartments or towers on each face (north, west and south) of the temple, separated by four deep recesses, with a handsome sculptured ornament (purána kumbam) in each recess. Each projecting compartment has a fine sculptured figure, chiefly Saiva but not without important Vaishnava figures, and the plain intervals of flat wall are covered with (?) historical scenes of rishis, kings, worshippers and attendants, celestial as well as terrestrial, in low relief.

Above the double vertical story rises the pyramidal stubi in seven stories to the neck which is spacious and supports four bulls (as at Tanjore) below the dome or semi-dome.

The whole temple is of stone throughout, and the domed top is apparently carved to represent a copper tile or leaf-pattern covering, like that of the five halls (sabha) at Chidambaram.

The only or chief ornament of the pyramidal portion of the tower is the square and oblong cells of "Rath" (= car) or Gópuram (= spire-roofed) pattern, with their elaborate fan-shaped windows, like spread peacocks' tails.

There is little if any stucco to be seen, the whole being of pure stone.

On the east side and attached to the great stubi is the Méle-Mandapam (= a high court or west court), a three-storied portico or transept covering the cross aisle between the north and south entrances to the Temple; this is built to match the Vimána, as at Tanjore.

To its east again and attached to it, is the west wall and end of the great Outer court (Veli-mandapam), begun in the same magnificent scale

[·] See note above.

and style, but never completed: for it is broken down or left off rather abruptly, and finished by a plain large hall, completely enclosed by its four walls and flat roof, only half the height originally designed.

It measures 80 feet wide, North and South, and 163 feet long, West to East, with a plain doorway in the middle of the east end, having huge stone warders (dwárapál), but otherwise devoid of any fine ornamentation. It is 18 or 20 feet in height, and the roof is supported by four rows of plain stone pillars.

There is a large uncovered and incomplete portico in front (East) of the Veli-mandapam, approached by a double flight of steps from North and South and 10 or 12 feet above ground level, which is the level of the interior of the mandap and temple.

The court-yard of the temple is about 610 feet East and West, by 350 feet North and South, with a fine gópuram or entrance tower built entirely of stone (fast falling down) on the East, of grand but suitable proportions, not half the height of the temple itself. Usually the gópuram is 8 or 10 times as high as the temple sanctuary.

The court-yard or quadrangle was once surrounded by a double-storied open cloister of plain but solid stone work, said to have contained 365 cells (in the two stories), but only a few of these remain in the centre of the north wall there is a small plain doorway.

The surrounding wall was of stone and must have been about 25 feet high.

The sculptures round the base of the temple are very good in design and execution.

The architecture struck me as grand, simple and pure, with many traces of the wooden construction of which it is, in many respects, a copy; especially in the projecting beam-heads at the angles, each of which is surmounted by a rude lump roughly resembling a flattened spiral (conch-) shell, perhaps intended for the sálagrám (black ammonite or serpent-stone); only this is a Saiva temple.

I did not notice the Nága, but saw traces of trees with umbrellas over them.

The (proper) right hand Dwarapal has the right foot raised and resting on a stump (of a tree), encircled by a serpent with a half-swallowed elephant in its mouth, at all three doorways alike.

The projecting stone cornice of single convex flexure is massive, but does not stand out so far as in many more modern cases I have noticed elsewhere, but is, I should say, more free and prominent than some to be seen at Chidambaram.

I did not see the imitation of wooden rafters and laths, with nail beads &c., to be seen at Tinnevelly.

4

The usual Bull (Nandi) in front of the temple is a poor one, compared with that at Tanjore.

The minor temples and shrines in the court-yard are inferior and mostly in ruins.

One of the more conspicuous of the sculptures represents Siva coming out of an opening $(y \circ ni)$ or split) in a cylindrical stone column (or lingam).

This figure is represented at Tanjore and elsewhere, and is to be seen repeated here several times in various parts of the Gangaikonda Sholapuram temples.

A figure of a rishi (Márkanda) on his knees, with forehead on the ground, is below.

The pillars and pilasters are very plain, square in the four towers (or rath-like portions), forming the four corners of the stúbi, ornamented by pointed leaves below the capitals, which are very fine large tabular slabs.

The square pillars or pilasters are not cut away to the octagon form leaving square blocks, as is common. The pillars and pilasters of the next, intermediate, partitions or towers are octagon throughout, with similar lanceolate ornamentation and (octagonal) capitals.

The central partitions or towers have 16-gonal pillars and pilasters with similar ornaments and capitals.

The plinth moulding is very grand, bold and chaste. It re-called to my mind the pattern of the plinth moulding of an unfinished temple at Kuttálam (*Courtallam*) in Tinnevelly.

The flat portions of the walls are covered with (?) historical scenes in which rishis and country folk, herdsmen &c., figure largely.

There are three or four wells in the Temple court, one of which (the Sin(g)ha Tírtham) is connected with the legend of the founding of the temple and possesses a never-failing supply of very good water.

I noticed that the name on the Tamil inscriptions was Gangaikonda Sholapuram and Gangaikondapuram. The inhabitants now call it Gangaikandapuram. They told me that the Stalapurana or local historical record of Gangaikondapuram had been taken to Tanjore and a copy placed in the Rajah's library there, whilst a copy (or the original) was taken and kept by the copyist who now resides at Nachaiyarkovil (or at Tirichirai) near Kumbakonam.

Another place of interest I visited may be worth mentioning though quite modern, and that is Rámalinga-pillai-sálai, a remarkable church or college building, called variously *Pardésimaḍam*, and Sanmárga-Sabai, situate on the high road from "Cuddalore" to Vriddháchalam, a mile or

so west of the point where the high road from Madras (viâ Panrutti) to Kumbakónam crosses it.

A few years since, one Rámalingapillai collected followers and money and attempted to establish a new religion. He appears to have taught the ethics of Christianity without its theology. But I could not get at any precise particulars. Having collected some hundreds of followers (2000 was stated) and built his college, Rámalingapillai retired with some ceremony into concealment in a house, now styled "Tirumáligai," in the village of Mottukuppam, a few miles distant from the College.

He is said, by his followers who now await his re-appearance at "the last day," to have never come forth from the room in which he disappeared, or to have been seen again.

I think the true facts of the case are worth eliciting and putting on record. The building is a remarkable one of brick and *chunam* in the modern Eurasian composite style, and the domed part of the roof or cupola appears to be covered with sheet metal.

I also visited Chenji or Sanji-Kóṭṭai (Anglice Gingee), a remarkable precipitous bluff rock, covered with and surrounded by fortifications of no very ancient date apparently. It is just the kind of stronghold that was likely to be seized on and held as a citadel by the successive conquering armies that have overrun the Carnátik for some centuries past.

The most interesting thing I observed here, beside the natural fastness (a notice of which is to be found in the South Arcot Gazetteer), was a very rudely carved stone lying in front of a small shrine halfway up the rock on the south side, dedicated to a local goddess called Kamala-kanni-y-amman to whom human sacrifices were formerly offered. Plate I shows copy of a rough pencil sketch taken hurriedly on the spot. Four human heads occupy a square raised shield, with two parallel bars in the centre like a pair of dumbells with small knobs, which might stand for footprints. Each pair of heads is separated by a trisullike mark immediately above and below the pair of bars in the centre. Above these in the centre at top is a pair of ram's (?) horns, surmounted by a short transverse bar and appendage which I could not make out, and in the centre below, a corresponding pair of buffalo (? kulgá), horns and A bow to the right and five arrows to the left on the lower part of the stone, at each side of the raised part, complete the carving. The arrows are club-headed and feathered, and one of them is furnished with a hole at one end, as if to hold a line. The entire stone is an oblate circle about 31/4 feet high and 4½ feet wide, and not very thick, lying flat on the ground. Close to it is an upright figure of "Minudaiyan Virappan," with hands together in the attitude of respect or supplication, and a sacrificial post stood near.

6

The grám-munsif said that this "kóvil" or chapel was held in great respect by the country-folk and was originally there before the present fortifications were built. Sacrifices are still made in times of drought and dearth and are supposed to be very efficacious.

The temples at the base of Chenji and some of the sculptures and remains are very interesting, extensive and well wrought, but apparently modern, though quite deserted and going to ruin. The monkey god Hanumán is to be seen in several places sculptured on the rocks.

Since the road was made which passes through part of the Chenji fortress, it has been frequently visited and despoiled of its sculptured treasures. I was informed that the fine columns which adorn the "Place" at Pondicherry were removed hence by stealth, by an enterprizing Frenchman. But we need not grudge them, for they are appreciated highly where they are, instead of being neglected and lost sight of in the spot where they formerly lay.

Some very handsome sculptures have been removed and set up at Chittámúr, a few miles distant to the eastward, near a new temple built by a neighbouring chief.

The traditional founder of the fortress is said to be one Supálaka (or perhaps rather *Tupákala*) Náyak.

I may here mention that the Stalapurána of Senji-Kóttai was stated to have been taken away by the Collector of the District (S. Arcot), a few years ago, and never returned.

At Mailam (= Mayúrastalam) near Tindivanam, the Tamburán (or abbot) informed me that his temple was founded by King Jayamba or Jayambaga Mahárája, from the north, who also founded or built Senji-Kóttai. This old fellow is a very fine specimen of a man who never touches flesh or any cooked food, but lives on fruit and milk only. He has repaired and restored his temple and is now building a fine stone gópuram on which I was shown a sculpture of himself in the style of an old bearded Rishi. He reminded me of the Tamburán (or abbot) of Tiru(p)panandál near Kumbakónam.

Another very interesting place I visited near Tindivanam is Perumukkal ("Permacoil" of Orme and of the Indian Atlas, sheet No. 78). Perumukkal is the common pronunciation in the district. At the place itself it is called, and written also, Perumukkul.

Like Senji-Kóttai it has been a fortified stronghold for some centuries. It has a fine large stone mandap on the summit and some small temples or shrines, but the ruins of some larger ones strew the summit, sides and base.

The rock is an isolated one of dark granitic boulders, very precipitous in most places. It is the last to the S. S. Eastward of the rocky masses that stud the plain of the Karnatik to the south-west of Madras.

I noticed stone circles at its eastern base, as well as at other stony places to the west and south-west, on both banks of the Ponniyár (S. Pennár or Pinákini.)

Mr. Garstin in the S. Arcot District Manual gives Peru-múkal (=great travail), from a legend of Sítadévi having here given birth to twins. There are two villages near, called Nalmukkúl (or Nanmukkúl) and Palamukkúl, names having reference to the same legend. Mr. Garstin also mentions Jánikipéttai, and I may add Rámanáthapuram, all in the immediate vicinity. But the old Sanniyási or hermit sent for the stalapurána (kept by an artizan in the neighbourhood) and wished to show me from it that the proper name of the hill is Mukkiyáchalam, and that it is therein styled Madhyakási (Middle Kasi) and is the scene of Rishi Válmíki's penance, death and burial. A ruined shrine attached to the mandap is pointed out as the spot where he was interred.

There are the remains of many fine sculptures here, destroyed by the Muslim, and many inscriptions on the base of the temples.

The fort was held and besieged repeatedly in the wars of the Karnátik in which much damage was done by the roundshot.

The following observation may be worthy of record.

At Gangaikondapuram the wells are said to have a perennial supply of good water near the surface, that fails not in the driest seasons; and at Chidambaram the same is said of the great tank in the temple enclosure. At Tiruvadi (A.S. 79), close to Panrutti, I noticed in the bed of the Gedilam or Garudanadi (the "Cuddalore" river) a natural spring or fountain of clear water, welling up with some violence in the midst of the muddy river-water. It is said to be perennial and to be as good as Kávéri water, whence it is locally called Kolladatumólai = Kolladam or "water-spring".

In connection with these I may mention the artesian wells that have recently been opened at Pondicherry and suggest that the perennial supply at Gangaikondapuram, Chidambaram and Tiruvadi may be explained by there being at those places a connection with the water-bearing stratum which is the source of the artesian wells, underlying the extensive laterite beds of the Cuddalore or S. Arcot district. I have heard of other places, particularly near Villapuram on the South Indian Railway, where the subjacent springs have been tapped by the natives and the outflowing water long since utilized for irrigating their fields.

Rude Megalithic Monuments in North Arcot.— By LIEUT.-COLONEL R. B. BRANFILL. (With a Plate.)

I have just had an opportunity of visiting the disused tomb-field at Iralabanda Bápanattam, in the Palmanér taluk of North Arcot.

The tombs here are of unusual interest from the size, shape and arrangement of the slabs of which they are composed, and the rarity of their chief characteristic.

The usual kistvaen or megalithic sepulchral cell is enclosed by three concentric rings of upright stone slabs, each slab having its top rudely worked (chipped or hammer-dressed) into a semicircular or a rectangular shape, and set closely side by side alternately, the round-heads standing higher than the intermediate flat-heads by the amount of their semi-diameter, i. e., the height of the rounded portion, so as to form a parapeted wall of rounded merlons with flat silled embrasures.

These walls or parapets rise in three concentric tiers on a slight mound or cairn, a foot or so above the general ground level.

The outer circle or tier consists of some 24 slabs, nearly 3 feet wide, half of them being semicircular at top and standing about 3 feet high, the whole forming a ring fence or enclosing wall about 30 feet in diameter.

The second tier has 16 slabs, 8 of them round-headed, rising to a height of 5 or 6 feet above the cairn or mound; the whole forming an intermediate ring-wall about 22 feet in diameter.

The third or inner wall is composed of four prominent round-topped slabs, 8 to 10 feet wide, and 12 or 15 feet high above the cairn, and 4 or 5 feet higher than the other four flat-headed slabs that stand between them and complete the inner ring, an octagon of some 16 feet in diameter, or rather a square of 12 to 15 feet, with the corners cut off.

The kistvaen or sepulchral chamber nearly fills up the internal space, the capstone or covering slab of which sometimes projects horizontally beyond the chamber below it, so as to fit closely to the four great round-headed slabs that enclose it, the 4 flat-headed corner stones being only about the same height as the capstone, and narrower than the others.

The only entrance to the interior was apparently intended to be solely by small holes broken in the two or three central slabs on the east front, and nearly opposite to the similar hole in the eastern wall-slab of the kist. There is a kind of antechamber or closed portico between the inner chamber and the inner enclosing wall, provided with a moveable shutter stone or slab.

The stone slabs used throughout are comparatively very thin, being usually about 3 inches thick, and even the great capstones seldom exceed 6 inches.

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The whole forms an imposing structure, and recalls the idea of a small citadel or fortification.

There are many examples, perhaps a score or more of this pattern, still partly standing, and about as many more of a very similar kind, only without the round-headed projections, all the slabs in each ring or tier being of the same height, about 7 feet above ground level, and completely hiding the enclosed kistvaen.

Dividing the tombs into three classes according to size, and counting the fallen and half buried, as well as those standing, there are 170 of the 1st or biggest, 210 of the 2nd, and 200 of the 3rd or smallest sort, a simple kist composed of slabs from 2 feet square and upwards, more or less buried in the earth, and without any enclosing walls or circle of stones remaining.

Most of the tombs in this nekropolis are much ruined and overgrown by jungle so that I suppose there may well have been many more than 600 tombs here, within a space 500 yards long and 300 wide. The interments have but a shallow covering of soil, sometimes less than one foot.

On excavating they were found to yield the usual sepulchral relics, except that iron weapons were very scarce or entirely absent, whilst the terracotta coffers were more abundant than in the similar tombs of Mysore. In one, a few ornamental beads, similar to some taken out of the Coorg tombs, were found lying near the remains of a human skull.

Some of the coffers, sepulchral troughs or trays, were ornamented with a chain ornament in festoons and furnished with projecting rings or loops and prominent hooks, as if to hang garlands on. Some were mere small flat oval troughs, whilst others ranged up to 4 feet long, 2 feet wide and high, and were furnished with four or five pairs of legs.

Perhaps however I need only further mention the chief novelty that struck me, and this may be no novelty to others.

Two or three Tamil letters were found scratched on a fragment of a little bowl. They seem to spell the words saduma or chathum or chadud; the final letter (? m) is very doubtful and may be intended for a terminal d or t, if that were admissible.

I have some rough notes and sketches of a few of the monuments, but had no leisure to explore further. A careful collection and close scrutiny of every fragment of the pottery (which is abundant and of the rude but antique and polished kind) would probably yield some valuable and curious information as to the habits, &c. of the tomb builders.

The locality has a bad character for being feverish and is in a very retired part of the country just above the Eastern Ghats.

The way to it lies through Chittur and Palmanéri whence there is a good road for 15 miles to the S. W. to Baireddipalle, and thence a bridle path for 6 miles vid Neilipatla to Bápanattam. The nearest name marked

on the old Indian Atlas, Sheet No. 78, is "Yerlabundah" (? Irala-rock). The Irala are the wild folk who roam the jungle in search of forest products and a free silvan life. During the rainy season some of them are said to dwell in these tombs, many of which would afford them perfect dwelling-houses, and the marks and relics of their recent occupation are to be seen frequently and unmistakeably.

I know of but three or four other places where these peculiar rounded slabs are to be seen, but they will probably be found to be more common when looked for.

The Coins of the Mahárájahs of Kángra.—By C. J. RODGERS.
(With a plate.)

Kángra is the name of a fort and town situated at the junction of two mountain streams which form a tributary of the Bíás on its right bank ere it leaves the hills. The coins in the accompanying Plate II go by the name of Kángra coins now-a-days. Bnt the rájahs whose coins they are were known in history by the name of the Rájahs of Trigartta, the country of the three rivers, the Ráví, Bíás and Sutlej. The family of these Rájahs claims its descent from Susarma Chandra, governor of Multán at the time of the Mahábhárata. After the war was over they went to the hills for refuge and erected the fort of Kángra for their protection. The district under the Rájahs of Kángra seems to have been like all districts governed by such Rájahs in old unsettled times. Kángra was their mountain stronghold. The neighbouring district of Jalandhar was subject to them, and must have furnished a considerable portion of their revenue. So the Rájahs of Kángra would be known at that time as Rájahs of Jalandhar. Being of the lunar race they kept the title Chandra after their names.

The Indo-Scythians conquered the fort of Kángra. When Mahmúd conquered it "the genealogical roll of the Indo-Scythian princes of Kabul for sixty generations was found in the fortress of Nagarkot by Mahmúd's soldiers" (Kángra is known in the history of India by the name of Nagarkot). From this fact, and from the immense amount of wealth taken from Kángra by Mahmúd, General Cunningham infers that "Kángra must have belonged to the Rájahs of Kabul for several generations, and

• General Cunningham's Archæological Report, Vol. V, for 1872-3, p. 155. The General quotes Abu Rihán's statement as contained in Al Biruni. I may here state that I am indebted to this report for nearly all my facts concerning the Mahárájahs of Kángra and to General Cunningham for much valuable aid generously given when I began to collect the coins drawn in the plate.

that it was their chief stronghold in which they deposited their treasures."*
Not only this, but General Cunningham thinks that the wealth accumulated in Kángra at that time consisted of the silver pieces of the Hindu Rájahs of Kabul which are even now found so plentifully throughout the Panjáb—the coins of Samanta Deva, Syalapati Deva, Bhím Deva and Khadavaya Deva.†

One fact bearing strongly on this view the General seems to have overlooked. All the coins of the Kángra Rájahs with some few rare exceptions
are of the horseman type. Some are of the bull and horseman type with
the names of the Rájahs over the bulls. Nay more than this, the earliest
Kángra coins bear the name of Samanta Deva over the bull. That they
were coined in Kángra no one will doubt who will cast his eye over the
coins of the Rájahs in the plate. I once attributed the first two coins to
Susarma Chandra. But a careful examination of the letters together with
the results of a comparison of the letters of other coins with these, has
convinced me that they are the coins of Samanta Deva.

The list of names of the Rájahs of Kángra from Susarma Chandra down to the last Rájahs is of course obtainable. There is no reason for doubting its correctness. But as yet no coins have been found going further back than Prithví or Píthama to whom General Cunningham assigns the year 1330 A. D. This is an approximation only, but based on fair reasoning. Judging by the number of coins obtainable of any prince we may I think fairly infer the length of his reign. The fewness of the coins argues that the reign was short. Before Pithama I believe the coins of Samanta Deva were coined and used at Kángra. There are immense numbers of these coins found yearly in the Panjáb. Some of them have the horseman after the usual type, horse well shown and the whole body of the rider with letters on either side his head. The bull is well developed too and the name above it is generally legible. But the Kángra type of Samanta Deva, which the die-cutters of the mints of the Rájahs of Kángra seem to have slavishly adhered to, is unmistakeable, after it is once studied and known. The other well drawn coins are probably those of the Kabul or some other mint.

We must not be surprised if the coins of all the Rájahs are not obtainable. The coins of Kashmír, though very abundant, have many kings unrepresented. The coins of Chumba a neighbouring state to Kángra bear only the names of a few Rájahs, although the list of kings numbers no less than 170 sovereigns. Coining seems to have always been considered the peculiar privilege of paramount sovereigns or of independent rulers. Bearing this in mind, we need not wonder if any hiatus occurs in the lists of

[•] Ibid, p. 156.

[†] I have seen several hundreds of these coins this year.-C. J. R.

coins as compared with that of the Rájahs. Nor must we wonder if a small number of coins turns up bearing names of rulers to whom we cannot attribute any country. Jalandhar and Kángra must have been subject at different periods to Kashmír as well as Kabul and perhaps to Kanauj. General Cunningham gives the following list:—*

Accessions.	Name in list.	Name on Coins.	Remarks.
1330. 1345. 1360. 1375. 1390. 1405. 1420. 1435. 1450. 1466. 1480. 1496. 1510. 1528. 1563. 1570. 1585. 1610.	Prithvi. Purva. Rupa. Sringara. Megha. Hari. Karmma. Sansára. Devanga. Narendra. Suvira. Prayaga. Ráma. Dharmma. Manikya. Jaya. Vriddhi. Triloka.	Pithama. Apurvva. Rúpa. Singára. Mogha. Hari. Karmma. Sansára. Avatára. Narendra Ráma. Dharmma.	Contemporary of Fíroz. Brothers. Contemporary of Muhammad Sayid of Delhi, A. D. 1433—1446. There is one coin known of Devanga. Died 1528, A. D. Rebelled against Jahángir, 1619 A. D. Triloka was the last king who coined.

A little study of Plate II will show that the coins are of several kinds. The commonest is that which has a bull on the obverse, with the name of Rájah above the bull. The reverse in every case except one has on it what is intended for an image of the horseman and horse. But as a rule there are only the legless hind-quarters together with the thigh and boot of the rider visible. The one mark on nearly all of them is the spear the horseman carries. First of all fixing this and remembering that the spear is carried close behind the man's thigh, to the right should come the horse's head and to the left the hind-quarters. But in reality only portions come on the coin. The die must have been as large as the silver coins of Samanta Deva which are a little broader than a four-anna piece. The boot is in some cases fully visible. But the head of the horseman is nowhere to be found. The spear has a notch on it near the bottom and a flag at the top. So it was a regular lance. Whether the man wore armour or not we can't say.

These coins are found in considerable numbers not in Kángra itself, but in Ludiána, Jalandhar and Umritsur. Vast quantities of them are how• Vol. V, Archæological Report, p. 162.

ever annually melted down and very soon there will be no more obtainable. Some of them may contain a very small amount of silver. It is very seldom I now meet with any in Umritsur. It is so with everything. I do not know what provision Government may be making to secure a cabinet of coins for the museums of the country. I believe no provision whatever is being made. A few private collectors are at work for their own cabinets which in the course of a few years will find their way to Europe. coming generation will have to receive history on mere hearsay. The numismatic monuments are fast disappearing. The old Rájahs in many cases are known already only by name. No records are obtainable of them. One would think that before it is too late Government should interest itself in the matter. The British Museum is far richer in the coins of India than any Museum in India. This is a mistake. If India is to be for the Indians, it is a pity to export from the country all those mementoes of former things and dynasties. Patriotism and loyalty go hand in hand with us. would surely be wise in our Government to create a love of country in the hearts of the people of India. We want something to displace the grasping and selfishness which everywhere show themselves. The historic remains which lie round about us are not understood, or are rather misunderstood and not valued. History is taught as a matter of dates and names and is useless. Museums are collections of odd things which are to the educated and uneducated alike voiceless. The teachers of history cannot read the coins which would add interest to their lessons.

Of all the provinces of India, the Panjáb has more historic associations than any other. From the time of Darius to that of the Empress of India, the Panjáb has been an arena on which great struggles have taken place. Yet the coin cabinet of the Lahore Museum is wretchedly poor. A few Græco-Bactrian coins, a few Indo-Scythian coins and a few odds and ends with the names attached to them of the persons who presented them (!) are all that are visible to the ordinary visitor. The curator, in whose charge are the valuable coins which are always kept under lock and key, is generally engaged during the day. So visitors passing through Lahore see next to nothing of what ought to be visible at all times. There is no catalogue of the coins, and many valuable ones have been already lost. This is again a mistake. It is exactly the same at Delhi, where the coins are all in a box!!

These remarks are made not in a captious spirit, but with a real desire to direct attention to the proper use of museums and provincial coin cabinets, and also with the hope that both be made more use of in the education of the people for whom the museums were built and with whose money they are supported.

I will now proceed to make a few notes on the coins represented in Plate II.

- 14 C. J. Rodgers—The Coins of the Mahárájahs of Kángra. [No. 1,
- No. 1. is a coin of Samanta Deva. Obverse above bull Sri Sam: reverse horseman.
- No. 2. is a coin of the same prince, with Srí Samanta above bull, reverse borseman.
- No. 3. Píthama. Obverse Srí Píthama Chandra (Deva), reverse horseman.
- No. 4. Ditto Obv. ditto., rev. do.
- No. 5. Ditto. Obv. ditto., rev. do. Horse's neck ornaments shown and whole leg with pointed boot.
- No. 6. Apurvva. Obv. Mabarajah Srí Apurvva Chandra (Deva), rev. horseman pláin and horse's eye visible.
- No. 7. Ditto. Obv. Srí Apu(rvva) Chandra Deva Maharajah, reverse horseman.
- No. 8. Ditto. Obv. Srí Apurvva Chandra, rev. horseman.
- No. 9. Ditto. Obv. (Srí Apu)rvva Cha(ndra) Deva, rev. horseman.
- No. 10. Ditto. Obv. bull, above which Sri Apu(rvva), rev. horseman.
- No. 11. Rupa. Obv. bull, above which Srí Rupa Cha(ndra), rev. horse-man.
- No. 12. Obv. bull, above which Srí Rupa Chandra, rev. horseman. The horses of Nos. 10, 11 and 12, have beads round their necks.
- No. 18. Apurvva. Obv. (Apurvva) Chandra Deva Maha(rajah), rev.
- No 14. Singára. Obv. Mahárájah Srí Singára Chandra Deva, rev, horseman. Very poor.
- No. 15. Megha. Obv. Maharajah Srí Megha Chandra Deva, rev. horse-
- No. 16. Hari. Obv. Maharajah Srí Hari Chandra Deva, rev. horseman.

 Neck ornaments and eye of horse visible.*
- No. 17. Ditto. Obv. Mahárájah Srí Hari Cha(ndra Deva). The letters of the first line are all suspended from one line drawn across the coin as in Hindu letters. Rev. horseman, Head of horse, very much deteriorated.

(This king Hari soon after his accession tumbled into a well while out hunting. He was rescued after an interval of several days had elapsed. In that

• Since I wrote this article I have come across a coin of Hari . The coin in the paper is of Hari . Now in conversing a few days ago with General Cunningham on this matter I said that I was inclined to ascribe this rare coin to the king who was the brother of Karmma and who was hidden in a well for some days. He quite agreed with me. The coins of the paper which as I say are found in great numbers, would then resolve themselves into the coins of the king Hari who lived after Triloka, A. D. 1630-50, whose coins those of Hari resemble in make and letters.

interval however he was accounted dead: his brother ascended the throne, and his wives mounted the funeral pile. When he came back he found Karmma reigning, and he went and took up his abode in the outskirts of his brother's dominions. I cannot account for Hari's coins being so plentiful. Out of several thousands I have seen, I have seen only one of Karmma, while at least one-fourth of the whole must have been Hari's. A Hari succeeded Triloka: perhaps these or at least some of them may be his coins although General Cunningham's list closes with Triloka.)

No. 18. Karmma. Obv. bull, above which Sri Karmma, rev. horseman.

No. 19. Sinsára. Obv. Srí Sansára Chandra Deva, rev. horseman with a large flag on which is a peculiar mark.

No. 20. Avatára. Obv. Maharajah Sri Avatára Chandra Deva, rev. horseman.

(There is one coin of Devanga, the god-bodied, known; I gave one to General Cunningham.)

No. 21. Narendra. Obv. Maharajah Srí Narendra Chandra Deva, rev. horseman.

No. 22. Dharmma. Obv., in a square area which is surrounded by a circle of dots, Dharmma Chandra; rev., in a circle surrounded with a circle of dots, Durga Deví.

No. 23. Triloka. Obv. Maharajah Srí Triloka Chandra Deva. All the lines have the letters suspended from one line going across the coin. This coin and No. 3. are alike in this matter. Rev. horseman.

No. 24. Ditto. Obv. ditto without lines, each letter separate, rev. horseman.

Hinder part of leg and thigh visible and hind-quarters and legs
of the horse.*

The coins of Megha, Avatára Karmma and Dharmma are very rare. "The coins of Rupa, Singára, Sansára and Narendra are rare. Those of Pithama, Apurvva, Triloka and Hari are common. The Kángra types of Samanta Deva are very common."

. Where the whole name is not on the coins, the part omitted is in brackets.

Note on an Inscription found upon a stone lying near the ruins of a Masjid on Lanka Island, Wular Lake, Kashmír.—By Major H. S. Jarbert, B. S. C.*

The inscription which is in Persian, is as follows:—
این بقعهٔ چو بنیان فلک صحکم باد مشهورترین زیب در عالم باد
شه زین عباد تادر و جشن کند پیوسته چوتاریخ خودش خرم باد

May this edifice be as firm as the foundations of the heavens,

May it be the most renowned ornament of the universe,

As long as the monarch Zayn Ibád holds festival therein

May it be like the date of his own reign,—"happy."

As is well-known the letters of the Arabic alphabet, like those of the Hebrew or Phenician and consequently of the Greek, are used as numerals, and the grouping of certain letters into a suitable word is frequently made to serve as a memoria technica among the Easterns to recall a date. In the above inscription, the numerical value of the letters in khurram (غرم) happy) is 847 which is the year of the Hijra it is intended to record. This date is equivalent to A. D. 1443-4 during which Zayn-úl-Aábidín (the Zayn Ibád of the inscription—for both have the same meaning, viz., ornament of the Adorers) ruled in Kashmír.

It may be interesting to glance cursorily over the events which preceded the accession of this prince from the period of the close of the last Hindu dynasty in the eleventh century of our era.

The Hindu history of that country has been discussed in a short Essay by Horace Hayman Wilson which will be found in the XVth Vol. of the Transactions of the Asiatic Society. He takes as his guide the first of the series of the Raja Tarangini, by Kalhan Pandit who commences his history with the fabulous ages and carries it down to the reign of Sangrama Deva the nephew of Didda Ráni in Sáka 949 or A. D. 1027 approaching to what Wilson considers to be the Pandit's own time Saka 1070 or A. D. 1148. The next two works of the series, viz., the Rajavali of Jonah Raja and the Sri Jaina Rája Tarangíni of his pupil Sri Vara Pandit, continue the record to the accession of Fath Sháh, which Wilson places in A. H. 882, but is given by Muhammad Kazam author of the Persian history of Kashmír, as in A. H. 897 (A. D. 1491-2).

* [A rubbing of this inscription was sent to the Society by Mr. Arch. Constable. The stone bearing the inscription is apparently a slab of black slate, well polished and finished, and measures 21½ by 12 inches and 2½ inches thick. The rubbing was taken on the 22nd September, 1874. The inscription, as shown in the rubbing, contains several inaccuracies; thus in the 2nd line زيب is wrongly spelled زيب the 1st and 4th lines have جو instead of بهو. two dots being omitted apparently for want of space. Ep.]

In the following survey I have followed the narrative of this last mentioned historian who calls himself the son of Khayr úz-Zamán and who commenced writing his history in the year 1147 A. H. (A. D. 1734-5) during the reign of Muhammad Sháh of Hindustán. His work follows the order of the Sanskrit and is divided into three periods, the first treating purely of the Hindu dynasties, the second of the Muhammadan, and the third of the subjugation of the country by the House of Timúr, with some concluding remarks on the features and curiosities of the country.

With the second period alone is this Note concerned, and the narrative is taken up at the accession of the last Hindu Rajah Sahdeo in A. H. 705 (A. D. 1305-6). During his reign occurred an irruption of the Turks under Zulju whose ravages left for generations the traces of his incursion. Forced to leave the country in the winter after a stay of eight months, the army, betrayed by guides, perished in the mountain snows. Many of the inhabitants of the country had fled in fear of their lives, some to Tibet, others, including Rajah Sahdeo, to Kishtwarah where he remained in hopes of some day recovering his crown. His General Rain Chand who had been smong the fugitives returned to Kashmir with a refugee from Tibet named Rihjú to whom in former times he had accorded his protection. try was now in a state of anarchy, each petty chief asserting his own independence. Rám Chand and his people occupied the fortress of Lár. Rijhú* or Rinjú (for the name is indistinctly written) seeing his opportunity gathered a few followers round him, made himself master by stratagem, of Lár, put Rám Chand to death and took his family prisoners. (A. H. 725 A. D. 1324) openly assumed the sovereignty, married the daughter of Rám Chand and won to his side the son of that Chief by granting him the government of Lár and Tibet and appointing him to a high command in the army. Though Buddhism was nominally the prevailing religion at this time, the country was distracted by the dissensions of sectaries, whose hostile and contending claims to religious truth perplexed the inquirer dissatisfied with the national religion. Such an inquirer was Rájá Rinjú, who after much perturbation of spirits and constant prayer, was led by divine inspiration—so runs the simple narrative—to watch a Moslem at his devotions. He saw, admired and believed, and soon led his court and people to embrace the Muhammadan faith. This monarch died in A. H. 727, after a reign of a little more than two years and a half, and the ruins of a once noble alms-house and a splendid mosque attest his reverence for the faith of his adoption. His widow Kotahrini + married Udayn Deo, brother of the last Rájá, who continued with his consort to carry on the government till the year A. H. 742, when he died. One of the Generals of the army coming

The Rájataranginí has the name Rinchan.

[†] In the Rájataranginí Kotah Rani.

of a royal stock, named Shahmír who, settling in Kashmír in the reign of Sahdeo as a merchant, had fast risen to place and power, now thought himself strong enough to marry the twice-widowed queen and to usurp the crown. She refused his overtures, but he made himself master of her person, and she was forced to yield a reluctant consent to the espousals. She, however, slew herself during the marriage festival and Shahmír now became undisputed master of the crown (A. H. 743 A. D. 1342-3) and assumed the title of Sultán Shams-u'd-dín. He died in 747 A. H. (A. D. 1346-7) leaving two sons, Jamshíd and Ali Sher.

The reign of Jamshid was short. He was defeated and slain in battle by his brother who succeeded him in 748 under the title of Alá-u'd-dín.

Alá-ud-dín's rule of ten years is marked by no important event. He died in A. H. 748 (A. D. 1356-8) and was buried at Alá-u'd-dínpúra.

His son Shaháb-u'd-dín succeeded to the crown on the death of his father. He employed his energies in clearing the country of rebels and marauders, and annexed Pakli, Dantaur and the tract, called the Sawád Kabír, to the crown. He wrested Tibet from the ruler of Káshghar and ventured to march towards India, then ruled by Firúz Sháh. After a campaign in which the victory was with neither party, peace was concluded on these conditions that the country from Sirhind to Kashmír should appertain to Shaháb-'ud-dín, while all to the eastward should acknowledge the sovereignty of Firúz Sháh. Muhammad Kazam* notes with surprise that this fact, which he says is mentioned by many historians, is left unnoticed by the author of the Táríkh-i-Firuz Sháhi. I may add that it is equally omitted by Elphinstone. (A. H. 758, A. D. 1356-7.)

On his return to Kashmír, he built the capital of Shaháb-u'd-dínpúra of which now not a trace but the ruins of a mosque remain, and he destroyed the large idol temple at Bijárah.† In the year A. H. 778 (A. D. 1876-7) he died.

Kutb-úd-dín his brother succeeded him in A. H. 780 (A. D. 1378-9). He ruled with justice and moderation and was celebrated as a scholar and a poet. Kutb-úd-dínpúra commemorated his name and the metropolis of his kingdom. He died in A. H. 796 after a reign of sixteen years. During his time occurred the advent to the court of Sayyid Ali Hamadání, the sixteenth in direct descent from Ali-b-Abi-Tálib, the son-in-law of Muhammad. He was revered for his sanctity and eminent virtues, and his influence guided the counsels of the monarch. The Sayyid bestowed on him his own cap which Kutb-úd-dín wore in the royal crown. It is feigned that

[•] His son Muhammad Aslam, who is the author of the History of Kashmír entitled the Gohar-i Aslam and has made considerable additions to his father's work, goes so far as to say that the conquests of Shahab-úd-dín were carried northwards beyond the Oxus and southwards beyond Lahore.

⁺ Called also Bihárah or Bij Bihárah,

1880.]

its efficacy secured the throne to the monarch's successors until the reign of Fath Shah who directed it to be buried with him, from which period dates the decline of the dynasty.

His son Sultán Sikandar, better known by the title of the Iconoclast from the number of idols he destroyed, assumed the sovereignty in A. H. During his reign, the rapid advance of Timúr 796 (A. D. 1393-4). on his march to India, induced Sikandar to conciliate the Tartar conqueror by despatching his son Sháhi Khán known afterwards as Zayn-u'l Aábidin to his court with presents and friendly letters. Timúr gratified by this conduct, left him in possession of his territory but detained Shahi Khan in Samarkand which he never left until Timúr's death. Sikandar after a reign of twenty-five years and nine months, died in A. H. 822. A superb mosque which contained 372 columns, each 40 cubits in height and 6 in circumference, was begun and completed by him in the space of three years under the direction of two famous architects Khwajah Sudr-úd-dín Khorasáni, and Sayyid Muhammad Nuristáni. To his piety was also owing the erection of the great mosque of Bijárah, and with the exception of the rattle of the royal kettle-drums, no profane music was permitted to disturb the austere tranquillity of his capital. Through his munificence the walls of the romantic gardens of Shalimar were extended as far as the Parganah of Phág and their stability was assured or blessed by the burial beneath their foundations of all the Hindu works that could be collected. As these treated either of idolatrous rites, astrology or history that was fabulous, they were considered by the monarch as condign objects for destruction.

He was succeeded by his son Ali who reigned but six years and nine months. This prince bent upon performing the pilgrimage to Mecca resigned his kingdom in A. H. 828 into the hands of his famous brother Zayn úl Aábidín and set out on his journey. A. H. 822. (A. D. 1419).

A H. 828. (A. D. 1424-5.) Zayn úl Aábidín was noted early in life for his abilities. He employed the time he had spent in Samarkand in adding to his store of knowledge, and on his return to his country he brought with him a number of artificers, such as paper-makers, book-binders, carpet-weavers, saddlers and others to improve the industries of his own land. His brother Ali having reached the territory of his father-in-law the Jammu Chief, was persuaded by him to abandon his pilgrimage and resume his sovereignty. Returning therefore with an army, he was met by his brother Zayn úl Aábidín, who gave him battle, defeated him and placed him in confinement wherein he shortly after died. The powerful faction of the Gurjis who in the time of his father possessed great influence in state affairs, and who favoured the cause of his brother, was exterminated by him at Naushahr, at which palace he erected a place for his own residence.

His time was now spent in promoting the prosperity of his country

and in repairing the ravages of the irruption of the Turks under Zulju which the lapse of more than a century had not yet been able to efface. He was a liberal patron of men of letters and encouraged the progress of the arts, especially favouring the artificers whom he had introduced from Samarkand. He travelled much over his dominions and his Hindu and Muhammadan subjects lived at peace with each other undisturbed by religious dissensions, which if they arose were amicably settled by punchayets at which the monarch himself would preside. This conduct gained for him the title of the Great King.

According to tradition in the vicinity of the Wular lake once stood a city of which the Rájá was Sudrasen. By reason of the enormity of his crimes, the waters of the lake rose and drowned him and his subjects. It was said that during the winter months, at low water, the ruins of a submerged idol temple might be seen rising from the lake. Zayn úl Aábidin constructed a spacious barge which he sank in the lake and upon which he laid a foundation of bricks and stones till it rose high enough to be level with the water. Upon this he erected a mosque and other buildings and gave the islet the name of Lanka. The expense of the work was defraved by the fortunate discovery of two idols of solid gold which had been brought up from the lake by divers. On the completion of Lanka the king ordered a great festival to be held wherein great sums were distributed amongst the poor. Verses were written by the poets to commemorate this event, and among these the inscription under notice by Ahmad Allámah Kashmíri was engraved upon a stone and placed above the Mihráb or sanctuary of the mosque. This Ahmad Kashmiri was the author of the Núrnáma, a Persian translation made in the time of Zayn úl Aábidín of an ancient History of Kashmir in the Kashmirian language by Shaikh Nur-úd-dín His translation was made use of by Muhammad Aslam the son of Muhammad Azzam, in amending the omissions of his father's History. Mention of the slab with its inscription is made by Muhammad Azzam who gives a faithful transcript of the verses Muhammad Aslam states that he visited Lanka in 1167 A. H. (A. D. 1753) and observing the inscription carried it in his memory and records it in his work. His second line runs thus-

مشهور به زیب و زین در عالم بای

which shows that either his memory failed him or he was unable to decipher the line more correctly given by his father.

The further history of Zayn úl Aábidín it is perhaps unnecessary to record. He died in A. H. 880 (A. D. 1475) and was succeeded by his son Hydar Sháh. His tomb may still be seen below the Zayna Kadal, the fourth of the thirteen bridges that span the river Jhelam in its course through the valley of Kashmír.

Coins of the Sunga or Mitra Dynasty, found near Rámanagar or Ahichhatra, the ancient Capital of North Panchála, in Rohilkhand:—the property of H. RIVETT-CARNAC, ESQ., C. I. E., F. S. A., &c. Described by A. C. CARLLEYLE, of the Archæological Survey of India.

(With a Plate.)

The great ruined site of Ahichhatra, the ancient capital of North Panchála and now known as Rámanagar, has of late been yielding a plentiful supply of the coins of the Sunga or Mitra dynasty. Mr. H. Rivett-Carnac has been so fortunate as to procure a considerable number and variety of these coins from that find-spot, and he kindly placed them in my hands for examination and identification.

The fact of so many coins of this dynasty having been found so far to the north-west from their proper capital city, Pushpapura (or Pataliputra), may perhaps be held to be a proof of the wide extent of their sway. While making some excavations at Bhuila, the site of the ancient city of Kapilavastu, in the Basti district, I obtained a considerable number (probably about a hundred) of the coins of the Mitras, dug newly from the soil, in deep excavations, while I was present on the spot; they were mostly of Agni Mitra and Indra Mitra, with a few of other later kings of this dynasty. These coins were mostly of small size; but the coins obtained by Mr. Rivett-Carnac, from Rámanagar, are mostly of the largest size, with three or four only of the smallest size.

About one hundred and ten of these coins, belonging to Mr. Rivett-Carnac, have passed through my hands; and of these, several bear names of kings which are either new, or of rare occurrence, such, for instance, as Bhadraghosa, Phagūni-mitra, Surya-mitra,* and Anu-mitra,—besides several coins of Bhūnú-mitra, which were already known. The most numerous coins were those of Bhūni-mitra, and the next numerous were those of Phaguni-mitra,—after whom, in the descending scale of number, followed Agni-mitra, Bhānu-mitra, Surya-mitra, Bhadra-ghosa and Indramitra; with also a very few, from other localities, of the later kings, whose coins are of quite a different type, such as Vijaya-mitra, Jaya-mitra, Satya-mitra and Saya-mitra.

From the numerical proportion in which the coins of various kings are found in a hoard, we can generally make a pretty good guess as to who were the earliest, and who the latest, of the series. Thus, the king of

^{• [}This name was at first read Srayan-mitra by the author. General A. Cunning-ham first suggested the true reading Suya or Surya-mitra; see Proceedings As. Soc. Beng., January 1880; see also below p. 28, Ed.]

[No. 1,

whom the greatest number of coins are found in a hoard, may be accepted as being either the latest, or the contemporary king, of the dynasty, at the time when the hoard was buried or lost; while the king of whom the fewest and most worn coins are found may be accepted as the earliest, in point of time, of the series. But a similar numerical proportion of coins of different kings may, sometimes, also have been brought about by accidental circumstances; and therefore we must, in all cases, be guided by the older or later forms of the alphabetic characters, which appear in the legends on the coins.

But if we follow the rule enunciated above, in a general sense, with sufficient judgment and discrimination, we may apply it in the present case. Thus, as the coins of Bhúmi-mitra are the most numerous, in proportion, in the hoard found at Rámanagar, we may suppose that he was the latest king of the dynasty, at the time when the hoard was buried, and that the hoard was buried during his reign.

In like manner, as the coins of Phaguni-mitra are the next in point of number, to those of Bhúmi-mitra,—or in fact nearly equalling them,—and were, at the same time, far in excess of the coins of any of the other kings, we may conclude that Phalguni-mitra, was the immediate predecessor of Bhúmi-mitra.

The coins of Agni-mitra and Bhanu-mitra follow next behind, in numerical proportion. But as the coins of these two kings are nearly equal in number, it becomes difficult to decide which of them was prior to There is, however, one marked distinction about the coins of Bhánu-mitra and that is, that the central symbol, of the three symbols above the name, is always punched into the coin, with a square punch; and the symbol in this square punch-mark depression is generally a repetition of the raised symbol to the right of it; while on the coins of other kings, the central symbol is generally different from either of the other two. this central square punch-mark depression I have also found on a few coins of Surya-mitra, who, from the greater rareness of his coins and the rather more antique form of the alphabetic characters of the legend, I consider to have been a predecessor of Bhánu-mitra,—and from these two kings' coins having the square punch-marked depression in common, I should say that Bhánu-mitra must have been the immediate successor of Súrya-mitra. Agni-mitra must therefore be of later date, and should probably follow immediately after Bhánu-mitra.

The coins of Bhadra-ghosa are the fewest and the most scarce of all. And the alphabetic characters of the legend, are of an older type than on any of the other coins, and more nearly approach the forms of the old Lat character of Asoka. Moreover the large coins of Bhadra-ghosa are very much worn, so much so that the legend is blurred and indistinct.

But Mr. Rivett-Carnac has one most beautiful little coin of Bhadra-ghosa, of very small size, on which the legend is as clear and distinct as possible,—really wonderfully clear for such a small coin.

The occurrence of only one undoubted coin,—besides one doubtful one,—of Indra-mitra, in this collection, is somewhat puzzling to me,—because, from the style of the alphabetic characters on his coins, I do not think they are so ancient as those of some of the other kings; and I would be inclined to place him certainly after Agni-mitra. The only reason that I can offer for this comparative (and perhaps only apparent or local) scarceness of the coins of Indra-mitra, is that his reign may have been a short one, and either that his residence was in some different part of the country, or that the distribution of his coinage was partial I did not find that the coins of Indra-mitra were any more scarce than those of other kings, among the coins of this dynasty which I obtained at Bhuila (Kapilavastu).

But, in the present case of the Rámanagar coins, I think there may be another way of accounting for this, probably merely temporary or local, scarceness of Indra-mitra's coins. I would suggest that Indra-mitra was the son and immediate successor of Bhúmi-mitra, and that the Rámanagar hoard was buried immediately after the death of Bhúmi-mitra, and in the early part of the first year of the reign of Indra-mitra. This would account for the plentifulness of Bhúmi-mitra's coins, and the scarceness of Indra-mitra's, in the Rámanagar find.

I will now give a list of those Mitra kings whose names have been in any way authenticated; and I will place them in the chronological order in which I think they should be placed; and opposite to the names of those of whom coins were found in the Rámanagar hoard, I will place the number of each found, respectively.

Initial Date.	Names of Kings.	Number of Coins found at Rámnagar.
B. C. 178.	Pushpamitra, Bhadraghosa, Surya-mitra, Bhánu-mitra, Agni-mitra, Anu-mitra, Phaguni-mitra, Bhúmi-mitra, Indra-mitra,	7 10 11 1 28

I will now proceed to give a detailed description of the coins themselves, see Plate III.

I.—BHADRAGHOSA.

1. Coin, very small.

Obverse.

A square depression, caused by a die, containing the legend, with three symbols above it,—Bodhi Tree, Linga, and Serpents.

Legend-Bhadraghosasa.

Reverse.

A curious dumpy figure, as broad as long, of Buddha standing teaching.

2. Coin, large.

Obverse. A square depression, containing the Legend, with three symbols above it.

Legend-Bhadraghosasa.

(Note.—The three symbols above the legend are, to the left a Bodhi Tree standing on a square base or in a square railing;—in the centre, a linga guarded by two serpents (Nágs) which rise up on each side of it—; to the right, two serpents intertwined, forming a circular knot in the centre, with their two heads extending out, right and left, above, and their two tails extending out, right and left, below. This same description will apply to all other coins bearing these symbols.)

Reverse.

Two objects, not distinct.

II.-SURYA-MITRA.

3. Coin, middle-sized, pretty large.

Obverse.

In a square depression, the legend, with three symbols above it.

Legend-Surya-mitrasa.

Symbols above legend:—To left, Bodhi Tree, as before. To right, two serpents intertwined, as before. In centre, a square punch-marked depression, containing a symbol, which appears to be composed of several snakes intertwined.

Reverse.

Device indistinct. (But, on another coin, it appears to be the symbol of Sangha with the Buddhist Wheel of the Law, below it.)

4. Coin same size as the former.

Obverse.

In a square depression, the legend below, with three symbols above it. Legend—Surya-mitrasa.

Symbols above the legend:—To left, Bodhi Tree, as before. To right, two serpents intertwined, as before. In centre, linga guarded by two serpents (Nágs) whose heads rise above it on each side.

Reverse.

Apparently the symbol of Sangha, with the Wheel of the Law of Buddha. (This was referred to, in describing the previous coin, the reverse of which is defaced.)

III.—BHANU-MITRA.

5. Coin pretty large.

Obverse.

In a square depression, the legend below, with three symbols above it. Legend-Bhánu-mitrasa.

(Sometimes the last part of the name appears to be mitrasa.)

Symbols, above the legend. To the left, the Bodhi Tree, as before. To the right, two serpents intertwined, as before. In the centre, a square punch-mark depression, containing a symbol composed of four snakes intertwined, and forming a squarish shaped figure.

Reverse.

The symbol of Sangha surmounted by the Wheel of the Law of Buddha. But it is possible that it may be intended for a figure of the Sun (Bhanu) placed above a pedestal.

IV .- AGNI-MITRA.

6. Coin, large.

Obverse.

In a square depression, the legend below, with three symbols above it. Legend.—Agimitasa.

Symbols above legend. To left, Bodhi Tree, as before. To right, two serpents intertwined, as before. In centre, Linga, guarded by two serpents (Nágs), one on each side.

Reverse.

Figure of Buddha standing, with right hand raised, and rays radiating from his head. He stands on a Buddhist Railing, between two trees.

7. Coin, middle-sized, rather small.*

Obverse.

Legend and symbols the same as in the preceding.

Reverse.

Buddha standing, with right hand raised, and flames ascending from

• [This is a mistake; coin No. 7 in the Plate is not one of Agni-mitra, but of Bhúmi-mitra, like No. 10. By a mischance the wrong coin seems to have been sent to be figured; ED.]

No. 1.

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his head and shoulders. He stands on a sort of ornamental pedestal, probably representing the Lotus.

V.-ANU-MITBA.

8. Coin, very small.

Obverse.

Surface of obverse of coin, concavely depressed. Legend in a line below. Three symbols in a line above.

Legend-Anu-mitasa.

Symbols, the same as on the coins of Agni-mitra.

Reverse.

A Buddhist Railing. Above it, a large round ball, surrounded by a circle of dots. On each side below, a small round ball, with a curved semi-circular figure below it, the concavity of the curve being turned downwards; these two latter symbols resemble in shape the later modified old Indian form of the letter "T", just preceding the Gupta period. I think the central symbol above (namely the round ball surrounded by a circle of dots) may be intended to represent the Sun.

VI.—PHAGUNI-MITRA.

9. Coin large.

In a square depression, the legend below, with three symbols above it. Legend—Phagúni-mitrasa.

Symbols, above the legend. To left, Bodhi Tree standing on a square pedestal. To right, two serpents intertwined. In centre, a Linga, with two serpents (Nágs) twined round it, their hoods raised up on each side of it.

Reverse.

Buddha standing on a lotus, with a canopy over his head.

VII.—BHÚMI-MITRA.

10. Coin, large.

Obverse.

In a square depression, legend in one line below, with three symbols in a line above.

Legend-Bhúmi-mitasa.

Symbols, Bodhi Tree, Linga with serpents (Nágs), and two serpents intertwined in a knot,—as on the coins of Phaguni-mitra and Agni-mitra.

Reverse.

Buddha standing between two trees, on a Buddhist Railing. Rays or flames ascend from the head of Buddha.

VIII.-INDRA-MITRA.

11. Coin, rather small.

Obverse.

Legend and three symbols in a square depression, as on the other coins.

Legend .- Indra-mitasa.

Symbols, the same as on the two preceding coins.

Reverse.

A squat figure of Buddha, above a Buddhist Railing.

(Note:—The legend on some other coins of Indra-mitra, which I have seen, appeared to read simply as "Inda-mitasa," while on a few it seemed to have the still more mutilated form of "Ida-mitasa."

SUPPLEMENTARY NOTE.

Since my Paper on the coins of the Sunga or Mitra Dynasty was forwarded to the Asiatic Society of Bengal, I have seen in the collection of Mr. Rivett-Carnac, another apparently unique coin of a king of this dynasty called Ayu-mitra, which I believe to be a new name. This king must have been one of the latest of the dynasty, as the letters of the legend belong to the later Gupta period.

Description.

Coin, round, middle sized, copper.

Obverse. Bull.

Inscription, underneath, A-yu mi-ta-sa.

Reverse. Apparently a Peacock and Palm-tree?

The legend on this coin is clearly and distinctly just as I have given it above, and there can not be any doubt whatever about it. This coin therefore must not be confounded with the common, though similar, coins of Sava-mitra, with which I am well acquainted.

In order to complete the list, I may mention that I have heard from General Cunningham that he has a coin of a king of this Dynasty named Dhruva-mitra. But as I have not seen General Cunningham's coin and therefore I do not know its age, I can not tell where to place Dhruva-mitra in the line of succession. But no doubt General Cunningham will describe the coin himself.

With the sole exception of the last named king, I think I feel pretty certain of the place which the rest of the Mitra kings respectively should occupy in the order of succession. We now know of fourteen kings of this dynasty, and I would place them as follows:—

1.	Pushpa-mitra.	8.	Bhûmi-mitra.
2.	Bhadraghosa.	9.	Indra-mitra.
3.	Surya-mitra.	10.	Vijaya-mitra.
4.	Anu-mitra.	11.	Satya-mitra.
5.	Bhânu-mitra.	12.	Saya-mitra.
6.	Agni-mitra.	13.	Ayu-mitra.
7.	Phâguni-mitra.		-

The fourteenth king would be General Cunningham's Dhruva-mitra; but not having seen the coin, I can not tell in what position to place him.

Of course I have never seen any coin of Pushpa-mitra; but he is nevertheless sufficiently authenticated otherwise; but I have seen and examined coins of all the remaining twelve kings.

With regard to the name Surya-mitra, I may now state that I have since seen several other coins of this king, and that the result of my examination of these other and more perfect specimens is that the name must be read Suya or Surya Mitra; and in this I agree with General Cunningham. On most of these coins the name appears to read as Suya, with a dot (anuswara?) above the y; but on at least one coin, the name reads clearly as Surya, the repha appearing quite plainly on the top of the y.

Coins of Ghiás-ud-dín and Mu'az-ud-dín bin Sám.—By C. R. STÜLPNAGEL,
M. R. A. S.
(With a Plate.)

The extracts from the Tabakát-i-Násirí made by Sir Henry Elliot in his History of India contain but little information concerning Ghiás-uddín of Ghór, nor is this want of details much to be regretted except for the fact that the coins obtained hitherto generally join the name of this ruler with that of his younger brother Mu'az-ud-dín who is looked upon as the first Pathán king of Delhi. It is stated that when 'Alá-ud-dín Husain, surnamed Jehán-soz, ascended the throne of Fíróz-kóh, he imprisoned his two nephews Ghiás-ud-dín Muhammad Sám and Mu'az-ud dín Muhammad Sám in a fort of Wahíristán, and settled an allowance for their maintenance. He took Ghazní, but did not make it his permanent residence. After his death he was succeeded by his son Sultán Saif-ud-dín. This king released the two

princes, his cousins, of whom Ghiás-ud-dín dwelt peacefully at Firoz-koh, taking service with the Sultan Saif-ud-din, whereas the more adventurous Prince Mu'az-ud-din proceeded to Bámián and there found employment under his uncle Fakhr-ud-dín Mas'úd. But when Ghiás-ud-dín succeeded to the throne of Ghór after Saif-ud-dín's tragical death, Fakhr-ud-dín instigated his nephew Mu'az-ud-din to bestir himself and likewise acquire a regal position. The latter accordingly started in all haste to his brother's court where he was received in a friendly spirit. He served Ghiás-ud-dín one year, after which the countries of Kasr-kajúrán and Istiva, between Herat and Ghazní, were assigned to him; and at a subsequent period he obtained possession of the city Takinabad, specially noted as the largest town in the Garmsir. In 569 A. H. (1173 A. D.) Sultán Ghiás-ud-dín conquered the town of Ghazní, but returned to Ghór after placing his brother Mu'az-uddin upon the throne, who secured in addition the territories of Ghazni and the country round about in 570 A. H. In the third year after this time, Mu'az ud-din led his forces to Multán, and henceforth his history becomes merged in that of India. Of Sultan Ghias-ud-din scarcely anything more is known. but it should be remembered in his favour that, instead of getting his brother murdered, he treated him with the greatest kindness, and always associated his name with his own on the coins of the realm. Ghiás-ud-dín died at Herát in 599, and Mu'az-ud-din was murdered by the Gakkars at Rohtak in 602 A. H.

Coins in the joint names of Ghiás-ud-dín and Mu'az-ud-dín have already been published by Mr. Edward Thomas in his "Chronicles of the Pathan Kings of Delhi," two of which are of gold and two of silver, the latter being ingraved in the first plate and numbered one and two, the latter being identical with the one described by Wilson in the Ariana Antiqua, pl. XX, 29. I have lately acquired eight specimens of dirhems of these Ghori brothers. all of them different from those already described. Of these, three are similar to No. 1, pl. I of Mr. Thomas's book; see Plate IV. They are of silver weighing, on an average, 74 grains and have their legends arranged in three concentric circles, the patronymic occupying the centre. The first. however, differs in this that the outer circle containing the date (597) is found in the obverse with the name and title of Ghiás-ud-dín, and not on the reverse as on Mr. Thomas's coin. I thought it at first just possible that the engraver might have committed a mistake, and changed the outer circles of the obverse and reverse, but such a supposition is unlikely from the transcript of the coin in the body of the book, which clearly shows that the date belongs to the reverse. Moreover it is totally immaterial on which side the date is actually placed, and it is actually found on the reverse together with Mu'az-ud-din's name, on two of the coins described in the

sequel of this paper. Although the margins are both a little abraded, they can with ease be supplied from the next coin. I may, however, remark that this coin could not have contained the name of the month of the year, as there is not sufficient space for its insertion.

The following is the transcript:

Date 597.

Obverse.

First circle.
 الارهم في و و سنة سبع و تسعين و خبس ماية Second circle.
 الا الله الا الله العظم تحدد رسول الله السلطان الاعظم غياث الدنيا و الدين ابو الفتح
 Centre.

Reverse.

First circle. هو الزي رسل رسوله بالهدي و دين الحق ليظهرة • • • Second circle.

الناصر لدين الله السلطان المعظم معز

Third circle.

Centre.

The last two of the three coins with concentric inscriptions referred to above, differ from the first in this that they have the arrangement of date just as in the Thomas's pl. I, No. 1; viz., the date (596) is placed on the reverse containing the name of Mu'az-ud-dín. The size, however, is smaller, and the letters less bold. The Ariana Antiqua, pl. XX, 85 is probably a similar coin to my two; but as Wilson, owing to the worn condition of the coin in his possession, was unable to describe it, I include it in this paper. The outer circle of the obverse contains the Súrah common to all Ghori coins; the second has half the Kalima, which is afterwards continued in the second circle of the reverse; and the third circle and centre show the names and titles of Ghiás-ud-dín. The reverse has in the first or marginal circle the place of mintage and the month and year in which the dirhem was struck. Part of the second and the third circles and the centre, like those of the obverse, contain the titles and names, but of Mu'az-ud-dín.

Ghazni, month Zi-ul-hajja, A. H. 596.

Obverse.

هو الزي رسل رسوله بالهدى و دين العق ليظهرة على الدين كله ولو كور المشركون

لا اله إلا الله الناصر لدين الله السلطان الاعظم Second circle. غياث الدنيا و الدين ابو الفتح محمد بن سلم Third circle. Centre. Reverse ضرب هذا درهم في بلدة غزنه في ذي الحجه سنة ست و تسعد، First circle. خبس ماية محبد رسول الله السلطان البعظم معز Second circle. ادنيا و الدين أب المظفر Third circle. محمد بن سام Centre.

The other five coins have never been described before, as far as I know, and are quite of a new type. They were obtained from an itinerant Kabuli who was very shy in speaking of the place where they had been originally procured; but as in his conversation he said that he had been in Ghazni and Kabul, and had lately come to Lahore by way of Jellalabad, it may be reasonably presumed that they were not found in the Panjáb, but in the Kabul valley, or perhaps in or near Ghazni. All of these coins are likewise The weight is between 56 and 79 grains. The area on either side is a square composed of double lines, with the inscription arranged in five The enclosing margin is of course in four sections. It is bounded by The margins are partially abraded, but fortunately one coin is sufficiently well preserved and the following inscription can be therefore made out with accuracy:

Dates 597 and 598.

Obverse.

Area:-

لا اله الا الله

محمد رسول الله السلطان الأعظم

فياث الهنيا و الدين

Reverse

Area:-

الغامر لدين الله السلطان المعظم

ُ معز الدنيا و الدين ابو المطفر

صحبة بن سام معمد الدرهم في شهور سنة ثمان و تسعين و خمس ماية في شهور سنة ثمان و تسعين و خمس ماية

Of these five dirhems, four have the date on the reverse together with the name of Mu'az-ud-dín, and one on the obverse. None contains the place of mintage.

All these coins, bearing evidence to the joint rule of the two brothers, are dated 596, 597 and 598 A. H., and must have been issued towards the end of their reigns, for Ghiás-ud-dín died in 599 and his brother three years afterwards. Comparing the titles of the two sons of Bahá-ud-dín Sám, the elder, Ghiás-ud-dín, is always called "ul'azam" the greatest, Sultán, ul nasr-l-dín illah and abúl fath, whereas to his younger brother are applied mu'azm, "great," Sultán, nasr-l-dín and abúl muzafr. It was only after the death of Ghiás-ud-dín that Mu'az-ud-dín called himself by the higher sounding title of 'azam.

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A Collection of Hindi Roots, with Remarks on their Derivation and Classification.—By Dr. A. F. RUDOLF HOERIE VEORV

This Collection was prepared by me some years ago and was originally intended to form part of my Comparative Grammar of the Gaudian Languages, and to illustrate the Chapter on Roots. The present introductory remarks give the substance of that chapter.

The Hindí, like any other language, possesses roots. By this term I here mean the constant element in any series of sense-related words. Thus in the Hindí words bol-í "speech," bol-áhat "calling," bol-aná "speaking," bol-á "spoken," bol-ai "he speaks," &c. the constant element bol is the root; the remainder are suffixes and vary according to the meaning which is to be expressed by means of the root.

A root may be determined in Hindí, or for that matter in any Gaudian language, by detaching the suffix of the 3rd person singular present ai (or e) from the word, when the remainder will be the root. Thus in bol-ai "he speaks," kar-ai "he does," bújh-ai "he understands," bol, kar and bújh are the roots respectively.

For comparing Hindí roots with Sanskrit, this is the most convenient rule. For a large number of Hindí roots are not derived from the pure Sanskrit root, but from that modified form of it, which is confined to the present tense (or the so-called special tenses generally). Thus the Sanskrit root budh "understands," takes the form budhga in the present tense, whence arises the Hindí form bújh. From the Sanskrit budh comes the 3rd person sing present budhyate, in Hindí bújhai; but from it comes also the participle future passive boddhavya "to be understood"; in Eastern Hindí this form is bújhab or bujhib, Western Hindí

bújhibau, which transliterated into Sanskrit would be budhyitavya. This shows that in Hindí the form bújh acts as a root, precisely as budh does in Sanskrit.

Putting aside mere phonetic differences, as in the Hindí sikh or síkh, Maráthí sik "learn," Eastern Hindí char, Western Hindí chal "walk," the Gaudian languages differ very little with regard to their roots. There are, however, a few exceptional cases of roots which are confined to some particular Gaudian language. Thus "see" is in Sindhí pas, Maráthí páh, but in Hindí dis or dekh, the Sanskrit pas, preksh and dris; again "come" is in Sindhí ach, Bangálí áis or ás, but in Hindí áv or á, the Sanskrit ágachh and áyá.

Roots, as a rule, do not undergo any change, when entering into conjunction with suffixes; except in the formation of the Causal Verb, in which case a long vowel is always shortened; thus bol-aná "to speak," but bul-áná "to call"; chhor-aná "to loose," but chhur-áná "to cause to loose"; ghúm-aná "to turn," but ghum-áná "to cause to turn"; pí-ná "to drink," but pi-láná "to cause to drink", &c. There are, however, a few exceptional cases of changeable roots. These are kar "do," dhar "place," já "go," le "take," de "give," mar "die." These roots assume a considerably different form in the formation of the past participle and past tense; viz., the first five become ka or ki, dha or dhi, ga or gi, la or li, da or di respectively, and mar becomes mu. The regular, unchanged forms, however, also occur, and generally these three forms are peculiar to some one or other of the Hindí dialects. Thus the High Hindí has the past participle ki-yá "done," Eastern Hindí ka-il or ka-yal, but Western Hindí kar-au; Eastern Hindí also has the radical form ki in ki-his "he did," ki-hin "they did." So also High Hindi mu-á or mar-á "dead," Eastern Hindí mu-il or mu-al.

Roots, when determined as above explained, may be divided into two classes, primary and secondary. To the former class belong all those roots, the originals of which, though sometimes more or less disguised by subsequent phonetic modifications, exist in Sanskrit. Secondary roots are those, which have no Sanskrit original, though their origin can be traced to Sanskrit elements. Thus the Hindí root khá "eat" is a primary one; for its original is the Sanskrit root khád; but the Hindí root paith "enter" is secondary; for there is no Sanskrit root pravisht, though there is a Sanskrit participle pravishta "entered" (of the root pra-vis), from which it is derived.

Among the primary roots there are a few which have suffered no phonetic modification. Thus, the common root chal "walk"; W. H. chalai, H. H. chale, Skr. chalati, "he walks." (The E. H., however, has charai). But most of them have passed through some sort of phonetic

[•] h is a euphonic insertion, for the sake of assimilation to lih-is "he took", lih-in "they took".

change. These changes are of seven kinds, of which sometimes one, sometimes several have affected the same root. They are—

- 1. Simple phonetic permutation, consisting in the elision or softening of a consonant, the contraction of adjacent vowels, and the like. E. g., khá "eat," Skr. khád; chú "leak," Skr. chyut;—tor "break," Skr. trot (causal of trut); par "fall," Skr. pat;—paros "distribute," Skr. parivesh; ho "be," Skr. bhú (bhava), &c.
- 2. Incorporation of the "class-suffix," that is, the suffix, which in Sanskrit is inserted between the root and the personal endings, and according to which Sanskrit roots are divided into ten classes. In Hindí these suffixes are incorporated with the roots. Thus, bújh "understand," Skr. budh + ya (budh IVth class); kop "be angry," Skr. kup + ya (kup IVth); nách "dance," Skr. nrit + ya (nrit IVth); sun "hear," Skr. sri + nu (sru Vth); bhanj "break," Skr. bhanaj (bhanj VIIth); ján "know," Skr. já + ná (jñá IXth), &c.
- 3. Incorporation of the passive suffix ya. Thus, lag "belong," Skr. lag + ya; sich "irrigate," Skr. sich-ya; de "give," Skr. di + ya (di), &c.
- 4. Change of "class." In Sanskrit all roots are divided into ten classes, partly according to the various suffixes which some take before the personal endings in conjugation, partly according to internal phonetic changes which some undergo. The simplest roots are those of the VIth class; they are not subject to any internal change, but merely add the suffix a. In Hindí all roots alike are reduced to the simple form of the VIth class. This is done (a) by sometimes substituting the suffix a of the VIth class, for another suffix; or (b) by changing the final vowels of other class-suffixes (u in the Vth and VIIIth classes, \acute{a} in the IXth class) to a. Thus (a) páva "obtain" (VIth), Skr. práp + nu (Vth; as if it were práp + a VIth); mánga "ask" (VIth), Skr. márg + aya (Xth); again (b) kara "do" (VIth), Skr. kar-u (VIIIth, kri); jána "know" (VIth), Skr. $j\acute{a} + n\acute{a}$ (IXth, $j\~{n}\acute{a}$). That is, the Hindí roots $p\acute{a}v$, máng (बाँब), kar, ján, all of the VIth class, correspond to the Sanskrit roots práp, márg, kri, jñá, of the Vth, Xth, VIIIth and IXth classes respectively, &c.
- 5. Change of "voice." Some Hindí roots are derived from the passive base of a Sanskrit root. Thus, bhaj "break" (active), Skr. bhaj + ya "be broken" (passive of bhanj); de "give," Skr. dí-ya "be given" (dá); sak "can," Skr. sak + ya (sak); bik "sell" (act. intrans.), Skr. vikrí-ya (vikrí), &c.
- 6. Change of tense. Some Hindí roots are derived from the future base of a Sanskrit root. Thus dekh "see", Skr. drakshya (future of dris); (old H.) nakh or nañkh "destroy" or "throw away", Skr. nañkshya (future of nas); (old H.) krakh "draw", Skr. krakshya (future of krish); khech or khaich "draw," Skr. krakshya (future of krish).

7. Addition of the pleonastic suffix api. Thus suháv "please," Skr. sukh (as if it were sukhápi). In causal roots this is the universal rule; e. g., karáv (or shortened kará) "cause to do," as if it were derived from a Sanskrit root karápi (instead of kári).

It will be observed that the laws 2 and 4, and again 3 and 5 are closely connected.

The preservation of a final single consonant (especially a hard consonant) in a Hindí root is a sure sign of its having been affected by the 3rd or 5th law. The final g of such a very common root as lag would not have been able to escape elision during its passage through Prákrit, unless it had been protected by another consonant following it; Skr. lagati "he belongs" would become Pr. laai, H. lai; but Skr. lagyate is Pr. lagai, H. lagai or lage.*

The termination aya of Sanskrit roots (or rather bases) of the Xth class and of causals is contracted in Prákrit to e. This e is changed to a in Hindí, by the 4th law. Thus Skr. márgaya "ask" is Pr. magge, H. mánga (भाँग); Skr. troṭaya "break" is Pr. toḍe, H. toṭa. On the same principle the Skr. vikríya "sell" (pass.), which in Pr. becomes vikke, is H. bika; thus Skr. vikríyate "it sells," Pr. vikkeï, H. bikai or (contracted) bike.

Secondary roots may be divided into three sorts, according to the manner of their derivation; whence they may be called derivative, denominative and compound roots.

- 1. Derivative roots are those which are obtained by the shortening of a radical vowel. E. g., nah "flow" from nahá "bathe", Skr. sná. It will be observed that this process is the exact reverse of the well-known method by which Causals are formed in Sanskrit. These are made by lengthening a radical vowel; e. g., from the simple root kar "do" Sanskrit forms the causal root kári "cause to do," for which, by the 7th law, Hindí places karáv or kará. Now, mistaking nahá, which really is a simple root, to be a causal root (as if it meant "cause to flow"), Hindí re-derives from it a simple root nah; the pair of roots nahá and nah being, in outward appearance, exactly like the pair kará and kar.
- 2. Denominative roots are made by treating nouns, as if they were roots. The nouns which may be treated in this way are either substantives or participles. To the former class belong such roots as jam "germinate," derived from the Sanskrit substantive janma "birth" (of the Skr. root jan "be born"). Of the other kind are paith "enter," derived from the
- * This process is expressly mentioned by Prákrit Grammarians, in the case of a few roots; as Pr. rujjhai (or rubbhai) act. "he hinders" as well as pass. "he is hindered," from Skr. pass. rudhyats "he is hindered," while the Skr. act. is runadhi (VIIth cl.); see H. C. 4, 218, 245, 248. But it clearly occurred in more cases, than they recognized; thus, in all those cases enumerated in H. C. 4, 230. The case of the Hindí root bhaj "break" is exactly similar. See also S. Goldschmidt in J. G. O. Soc., Vol. XXIX, p. 492. and Weber Saptaşataka, p. 64.

Sanskrit participle pravishta "entered" (of the Skr. root pra-vis "enter"); beith "sit" and pith "beat", derived respectively from the Sanskrit participles upavishta "sitting" and pishta "beaten" (of the Skr. roots upavis and pish).*

3. Compound roots consist of the Sanskrit root kri "do" or "make," and some noun governed by it in the accusative case; in fact, they represent phrases in a contracted and much corrupted state. They can easily be recognized by their terminal consonant k, which alone remains of their original radical element kri. Thus chuk "cease" is derived from chyst + kri, which is a compound of the Sanskrit noun chyst "flowing away" and kri "make;" e. q., the Skr. 3rd pers. sing. pres. chyut-kriyate, lit., "he is made a flowing away," is Pr. chukkei, H. chukai (or chuke) "he ceases." Similarly ruk "stop" or "be hindered" comes from rut + kri, i.e., from the Sanskrit noun rudh "hindrance" and root kri "make;" again kasak "be pained" or "suffer pain" from kasham + kri, i. e., from the Skr. noun kasha "pain" + kri "make." It is probable, I think, that the Prákrit termination (3rd sing. pres.) kei, Hindí kai or ke, is phonetically derived from the Sanskrit passive krivate "he is made," Skr. rut karoti would mean "he makes a hindrance"; this phrase, being treated as a compound word, would form the passive rutkrivate, + "he is made a hindrance" or "he is hindered," whence would regularly arise the Prákrit rukkei, and the Hindi rukkai or rukke "he is hindered." Many of these compound roots are intransitive, which would naturally agree with their derivation from a Sanskrit passive root or base. Others which are transitive could, however, be no less easily derived in the same way, by the aid of the fifth of the above-mentioned laws, the "change of voice."

By far the largest number of Hindí roots can be brought under one or the other of the above-mentioned classes. Still there remains a small number of roots, the derivation of which, as yet, cannot be satisfactorily explained; e. g., dho "carry," laut "return." Even these, further research will probably show to belong to one of the two great classes.

The root dekh claims some special consideration on account of the controversy regarding its origin to which it has given rise. Various

[•] Beames in his Comp. Grammar, Vol. III, p. 37 (footnote) says about me that "he discussed this as if it was his own discovery in Indian Antiquary, Vol. I, p. 367." The word "if" is superfluous. The fact is, my article appeared in the December number of that Journal in 1872, and was written some months previously. Beames' Ist Vol. appeared towards the end of that year, and I did not receive it till after some time in 1873; so that when I wrote the article, it was impossible for me to know, that my views had been anticipated by Beames; though, indeed, it may be questioned, whose the merit of the first discovery is, if such a matter can be dignified by that name. Moreover my theory has a much wider application than Beames', as it includes nouns as well as participles.

⁺ A mongrel form, no doubt, but nothing unusual in colloquial speech.

theories have been put forward,* among which that of Childers is now probably more generally accepted than any other. Stated briefly, his theory. as first applied to the Pali root-form dakkh, is that this root is derived from the Sanskrit future base drakshya (Skr. drakshyati = Páli dakkhati), its original future meaning having been forgotten in later timest. The theory, if true, must, of course, equally apply to the root in its Prákrit and Gaudian form dekh. In this form, however, it can hardly be directly connected with the future base. But there is, both in Prákrit and Gaudian, another very common root pekh, also meaning "see". appears to me most probable that the original form dakh was in course of time changed to dekh, in order to assimilate it to pekh. The formation of such, more or less unintentional, assimilations is quite in keeping with the genius of vernacular languages. There are some very striking instances in Hindí. For example there is in E. Hindí the pair of roots de "give", and le "take", representing the Sanskrit roots dá and labh. The 3rd singular present are dey, ley, Pr. dei, lei; here ley and lei "he takes" are formed in assimilation to, or after the analogy of dey and dei "he gives". Prákrit has also the regular form lahaï "he takes", from Skr. labhate. Again the E. Hindí has the past participles dihal "given", lihal "taken"; here dihal is formed after the analogy of lihal, from Prákrit lahida. From the transitive pair of roots pekh and dekh, another, similarly assimilated, pair pikh and dikh is derived with, generally, § an intransitive meaning "be seen", "appear". A more serious objection to Childers' theory, in my mind, was the fact, that the origin assigned to

• The whole subject of this controversy will be found briefly, but lucidly reviewed in Beames' Comp. Grammar, Vol. III, pp. 45, 46. He does not mention, however, the ingenious theory of the two Goldschmidts (Paul and Siegfried), who explain dekkh as a denominative root derived from the past participle drishta, by assuming the well-known modern pronunciation of \P sh as \P kh to have already existed in Prákrit; (see S. Goldschmidt's Prácrtica, pp. 6—8, and P. Goldschmidt's Essay in Göttinger Nachrichten, 1874, pp. 518—520). But there is no evidence, really, of the existence of that usage in Prákrit; moreover in the modern vernaculars, \P would not be pronounced \P , when it stood first in a conjunct, but only when it stood singly or second in a conjunct: thus one might hear purukh (\P \P) or barkhá (\P \P), but not jekhth (\P \P), always jeshth).

† In Kuhn's Beiträge zur vergleichenden Sprachforschung, Vol. VII, p. 450; also in a private letter to myself.

t Beames also was of this opinion in his Comp. Gr. Vol. I, p. 162, where he remarks: "it is perhaps worth notice that in scenic Prákrit a very frequent word for 'seeing' is pekkh, and that possibly the existence of this verb may have had some influence on the creation of the somewhat anomalous form dekh. The idea is based on the well-known fondness of the Indians for jingling words of similar sound." He now appears to have abandoned it, in Vol. III, p. 46. But it cannot be dispensed with; so far at least, as the relation of the later dekkh to the earlier dakkh is concerned.

§ In the old Hindí of Chand's Prithirája Rasau, dikh and pikh are commonly used in a transitive sense (see, e. g., the verse on p. 39); also in modern Hindí occasionally.

dekh seemed to be an unique one. So far as I know, no parallel case of such a process of creation of a new root from the future base has hitherto been shown to exist. Quite lately, however, in my reading of Chand's Prithirája Rasau, preparatory to my edition of it in the Bibliotheca Indica,* I have come across two other striking instances of that process, so that I now incline to consider Childers' theory to be fully proved. For this reason, I have now† inserted it in the list of laws of formation of roots, above enumerated. Those two instances are the roots nakkh or nankh "destroy" or "throw away" and krakkh "draw" or "pull." The former occurs, e. g., in the following verses:

इटकि तसवी कर नंबे ॥ (or नक्षे) 27, 88.

i. e. "impatiently he throws away his rosary with his hand"; again इय सार सुष्यं निसंतंत नथं॥ 27.84.

i. e. "the chiefs of the cavalry he fearlessly destroyed."
The root krakkh occurs in the following lines:

विना सज्ज पन्वे सची दंदि पिथी। सनों डिंभरु जांनिकी सीन ऋषी॥

i. e. "unblushingly searching for a partner, Sachi (wife of Indra) espied him, and, like as the fish her young, so she drew him to herself."

Now the origin of these two curious roots finds a very easy explanation, by applying to them Childers' theory. The future of the root nas "perish" is in Sanskrit nañkshyati, which would be Pr. nañkhaï or nakkhaï, whence in Hindí nañkhai or nakkhai with meaning of the present. It is to be noted, that in Hindí the meaning of the root has become transitive (by the 5th law). Similarly the Sanskrit future of the root krish "draw" is krakshyati, Apábhramsa Pr. krakkhaï, whence in Hindí, with meaning of present tense, krakkhaï. It should be observed, that the rhyme in the above lines would require krikhyau or a root krikh. This may serve to illustrate the process by which assimilations of radical forms are brought about in the vernaculars.

But further there is a another well-known Hindí root, the origin of which, hitherto very puzzling, now finds an easy solution and thus serves as an additional confirmation of Childers' theory. This is the root khech or khaich or khench (a) or khainch (a) "draw." The Sanskrit conjunct ksh may change in Prákrit to kkh or chchh; thus the Skr. root preksh "see" becomes pekkh or pechchh in Prákrit; the Sanskrit future base drakshya

[•] Three fasciculi of this Epic have been published, one of the 1st Vol. by Mr. Beames, and two of the 2nd Vol. by myself; a fourth fasciculus (3rd of Vol. II) as well as an annotated English translation of the 1st fasc. of Vol. II will appear in the course of this year.

[†] It is not in the list given in my Comparative Grammar, pp. 161-171.

"will see" becomes dakkha or dachchha in Prákrit (see H. C. 3. 171).* Similarly the Sanskrit future base krakshya or karkshya would, in Prákrit, become kakkha or kachchha; and the Sanskrit compound future base ákarkshva (of root á + krish "draw") would become áakkha or áachchha. With the insertion of the usual euphonic v. the latter would become ávachchha. The Prákrit 3rd singular future accordingly might be awachchhai or (with the not unusual nasalization instead of the reduplication of a consonant) ayanchhai; and, assuming Childers' theory to be true, this form might occur as a present, equivalent to the Sanskrit karshati. Now what I have thus constructed theoretically, is an actual fact, as testified by Hema Chandra in his Grammar (4, 187). He gives the following forms ayanchhai, ayanchhai, ainchhait as Prákrit equivalents of the Skr. karshati. The last form annchhai () has arisen by contracting va into i, and is that form which has immediately passed into Hindí, with this difference only, that chh has been disaspirated (a process not uncommon in the modern vernaculars). Hindí has ainchai or enchai (एँचे or एँचे). Now to return to khech and its compeers; the uncompounded root krish would yield a Prákrit form kachchhai or kañchhai, which in Hindí, by transferring the lost aspiration of chh to k and by assimilation to ainchai and enchai, would result in the modern forms khainchai or khenchai (वैचे or चेंचे), or without nasalization, khaichai and khechai. It will be observed that the later forms khenchai or khainchai are related to what would be the earlier forms khañchai or kañchhai. just as the modern dekhai and Prákrit dekhhai are to the Páli dakkhati.

There are two other roots which also deserve a special word. One is the root hokh "be" or "become." It is an equivalent of the commoner root ho by the side of which it is very commonly used in Eastern Hindí. In Western Hindí, I believe, it is unknown. It is regularly conjugated, through all tenses. Its origin is obscure. I am inclined to look upon it as formed by the same (practically pleonastic) suffix sk which also occurs in such roots as achchh "be", gachchh "go", yachchh "hold", the element sk would change in Prákrit either to kkh or to chchh; so that bhúsk (or bhavask) would become Pr. hokkh, H. hokh, just as ásk (of ás) becomes Pr. achchh, H. achh, or gask (of gam) becomes Pr. gachchh. Possibly—though I do not think it, probable—the origin of dekh might be accounted for in a similar way.

[•] See also footnote on page 49. The Prakrit word sarichchha "similar" exhibits the root-form dichcha, which is to dekkh (or dickh), as pechehh is to pekkh. On the other hand its Sanskrit equivalent sadriksha exhibits the Prakrit root dekh or dichh in its Sanskrit dress driksh, and is, I believe, the only instance of the admission of that mongrel Prakrit root into Sanskrit.

[†] The MS. readings vary. H. C. also gives the forms anachchhaï and ñachhaï; in the former the nasal has been transferred to fill up the hiatus, in the latter ás is contracted into a.

The other is the still more common root dv (or H. H. d) "come." Its origin has, I think, not yet been satisfactorily explained. One would naturally connect it with the Skr. root á-yá, from which, clearly the Maráthi root ye "come" is derived. But this does not explain the terminal consonant v in the Hindí áv. Now it is a curious fact, that the root áv imitates, in every respect, the conjugational forms of the root páv (Skr. práp = pra-áp), instead of those of the root já "go" (Skr. yá) which one would expect it to follow. Thus, present participle E. H. ávat or W. H. áratu "coming," E. H. pávat or W. H. pávatu" "obtaining," but E. H. ját or W. H. játu "going;" past participle E. H. áil or áyal or ává, W. H. áyau "come," E. H. páil or páyal or pává, W. H. páyau "obtained." but E. H. gáil or gayal or gayá, W. H. gayau "gone;" 3rd sing. present H. ávai, H. H. áve "he comes," H. pávai, H. H. páve "he obtains," but H. jáy, H. H. jáe "he goes." I incline, therefore, to think that there is here another instance of the, already noticed, tendency of the Indian Vernaculars to assimilate verbal forms, so that the v in dv is due to the influence of páv; an influence, natural enough, when it is remembered that v, equally with y, is often inserted between two adjacent vowels for the sake of euphony. † This assimilation is a very old one. There are traces of it in Prakrit as well as in the Gipsy dialects. In Prakrit there is the 3rd sing. pres. ávei, † and shortened ávai (H. C. 4, 367) "he comes." The regular Prákrit form would be ááaï or shortened ááï (see H. C. 4, 240); but just as there is utther or shortened utthar (H. C. 4, 17) for uttháai or utthái (see Vr. 8, 25) "he stands up" (of root ut-sthá), so there might be áci or áci (of root á-yá), from which, by the insertion of the connecting consonant v, there would arise avei and avai. §

The following List of Hindí Roots is arranged alphabetically, in two parts. Part I contains primary roots, while Part II consists of secondary roots.

- * Páyatu in Kellogg's Hindi Grammar, p. 202, § 377, is a misprint.
- † This influence of páv even intrudes occasionally into the conjugation of já "go"; thus the E. H. has sometimes jává "gone," like ává, pává; and the 3rd sing. pres. jáve is rather common in H. H. beside jáe or jáve.
- ‡ This form is quoted by Dr. R. Mitra from the Pingala in the Vocabulary appended to his edition of the Sankshipta-sára. I have not been able to verify it; but the form is not intrinsically improbable.
- It is just possible to connect dv with the Skr. root api-i; thus 3rd sing. apyeti Pr. appei or dpei or dpei (cf. kddum "to do" for kattum). H. C. 4, 400 seems to refer it to Skr. d-pad (or better d-pat?). The Bangálí uses an altogether different root, ais or ds. Beames, in his Comparative Grammar (III, pp. 44, 45) rightly refers this root, as well as the Sindhí ach, to the Skr. root d-gachh (of d-gam). Disaspiration of an aspirate and pronunciation of chh as s are not uncommon in the Indian vernaculars (see my Comparative Grammar, f 11, 145, exc. 2). The root d-gachh would become in Pr. d-achh (see Delius, Radices Pracriticae, pp. 69, 70) or d-yachh; by contraction in Pangálí, the former would become ds (for d-d-d), the latter dis (for d-d-d). The root sis might, however, be also referred to the Sanskrit root d-v-v:

PART I .- Primary Roots.*

- 1 মহ roam = Skr. মহ, Passive মহান (with active sense), Pr. মহুহ (H. C. 4, 230), H. মই.
- 2 चनुषर् resemble = Skr. चनु + च, I. cl. चनुषरित, Pr. चनुषर्द् (H. C. 4, 259 = Skr. सहस्रोभवति), E. H. चनुषरि.
- 3 चार come, see introductory remarks, p. 41.
- 4 चार्र् feed = Skr. चा-चू, I. cl. चार्रात, Pr. चार्र्स् (H. C. 4, 259 = Skr. चार्त्त), E. H. चार्स्स.
- 5 আৰু pluck up = Skr. অনু ক্রম্, I. cl. অন্তর্গনি, Pr. আছুর (H. C. 4, 187), H. অভার (with transfer of aspiration, as in বিৰ, see p. 40 and my Comp. Gramm. § 132); see No. 28.
- 6 जवाङ् reveal = Skr. जद्-वट्, X. cl. जहाटयति, Pr. जमाडेर् or VI. cl. जमाडर् (H. C. 4, 33), H. जवाडे.
- 7 जह rise = Skr. जन्न-स्था, Passive जलीयते (with active sense), Pr. जहेर् (cf. E. M. p. 27 and Ls. p. 345, also जलेर) or VI. cl जहर (H. C. 4, 17), H. जहे. In Pr. also VI. cl. जहाबद or contr. जहार (Vr. 8, 26), in H. deest.
- 8 অৰু fly = Skr. অত্-তী, IV. cl. অন্ত্ৰীখন, Pr. অন্ত্ৰ (Cw. p. 99, Spt. v. 223) or VI. cl. অন্তৰ, H অৰু.
- 9 जतर् descend = Skr. जत्-तृ, I. cl. जतरित, Pr. जतरर् (H. C. 4, 339), H. जतरे.
- 10 তহন intr. upset, come off from, come down = Skr. তন্ম্ল, I. cl. তন্ম্লনি (তহনি), Pr. তথার (H. C. 4, 174), H. তহনি.
- 11 उचार or उचान tr. upset, take down = Skr. जन्मन, Causal जन्मान्यति, Pr. जन्मान्द्र or VI. cl. जन्मान्द्र, H. जन्मान्द्र or उचारी.
- 12 जपज् grow up = Skr. जत्-पद्, IV. cl. जसदाते, Pr. जपज्जद (cf. H. C. 3, 142), H. जपजे.
- 13 जबस boil = Skr. जब्-जस्, I. cl. जङ्जस्ति, Pr. जजस्त, H. जबसे; cf. root वस्त.
- 14 जवार keep in reserve = Skr. जब्-ह, Causal जहारवित, Pr. जबारेइ or VI. cl. जबारइ, H. जबारे.
- 15 जभार् raise up, excite = Skr. जब्-ध, Causal जङ्गारयित, Pr. जन्मारेड्र or VI. cl जन्मार्ड, H. जमारे.
- 16 অংশ্বল অল্প grow up, also reprove = Skr. অহ্-জন, I. cl. অজনন, Pr. অল্প (T. V. 3, 1. 133 = নিয়াংনি, H. C. 4, 259 has অল্পুর), E. H. অংশ, W. H. অল্প. In the sense "reprove" perhaps connected with অল্থ ?
- 17 जहर subside = Skr. चव-ह, I. cl. चवतरित, Pr. बोहरदू (H. C. 4, 85 बोहरदू, v. l. चहरदू (with euphonic क्), H. जहर्र.
- 18 कैंच् be drowsy = Skr. ? , Pr. उंचर (H. C. 4, 12 = निदायित), H. केंच्.
 - · See List of Abbreviations at the end of this article.

- 19 कम be excited, raised up = Skr. जद्-मू, I. cl. जद्भवित, Pr. जवभविद् (Vr. 8, 3) or जब्बाद (cf. अंति for भवित H. C. 4, 365), H. कभे; or denom. from कार्च, Pr. जब्भ, cf. H. C. 2, 59.
- 20 wis see secondary roots.
- 21 बाह् burn = Skr. चव-कुट्, IV. cl. चवकुट्यति, Pr. बाज्यस्, H. बाहै.
- 22 बास rot = Skr. चप-वस्, I. cl. चपवसति, Pr. चववसद् or बावसद्, H. बीस (for बाउसे).
- 23 कर् do = Skr. छ, VIII. cl. करोति, vedic also I. cl. करति, Pr. करह (Vr. 8, 13), H. करें. In Pr. also X. cl. करेंद्र (H. C. 4, 337); Vedic also V. cl. छशोति, Pr. कुक्ट्र (Vr. 8, 13), deest in H.
- 24 बस् test = Skr. बस्, I. cl. कपति, Pr. कसइ, H. कसे.
- 25 कम् tighten = Skr. छम्, I. cl. कर्षति, but also VI. cl. क्रपति, whence Pr. कसद, H. कमें.
- 26 कर् say = Skr. कथ्, X. cl. कथ्यति, Pr. कहेर् (Spt. v. 35) or VI. cl. कश्च (H. C. 4, 2. Cw. p. 99), H. करे.
- 27 काट cut = Skr. इ.त., Causal कर्तथित, Pr. कहेर or VI. cl. कहर, (cf. 1. sg. कहले H. C. 4, 385), H. काटे.
- 28 Tre draw see secondary roots.
- 29 कांप् or कप् tremble = Skr. कंप्, I. cl. कम्पति, Pr. कंपर् (H. C. 1, 30), H. कांप् or कपे.
- 30 किम् or कीन् buy = Skr. जी, IX. cl. जीशांति, Pr. किश्रू (Vr. 8, 30) or किश्रू (Dl. p. 22), H. किने or कीने.
- 31 बूट् pound = Skr. कुट्, X. cl. कुट्यित, Pr. कुट्टेर or VI. cl. कुट्टर, H. कुटे. 32 बूट् or कुट्ट् jump = Skr. आह्र (or आह्र), I. cl. आह्रोत, Pr. कुट्टर, H. कुटे.

or **कू दें**.

- 33 कोड् or कोर् scrape, dig = Skr. कुट, X. cl. कोटयते, Pr. कोडेर or कोडर, W. H. कोडे or E. H. कोरे.
- 84 कोष be angry = Skr. कुष्, IV. cl. कुष्पति, Pr. कुष्पर् (H. C. 4, 230), H. कोषे.
- 35 वप् be expended, sold = Skr. वप् (X. cl. or Causal of वि), Passive वस्ति, Pr. वस्त्, H. वर्षे.
- 36 **खा** eat = Skr खाद्, I. cl. बाद्दित, Pr. खाचार or (contracted) खार (H. C. 4, 228), H. खाय्.*
- 37 बांस् cough = Skr. कास, I. cl. कासते, Pr. कासइ or बासइ, (cf. H. C. 1, 181, बारियं = कासितं), H. बांसे.
- 38 विक be delighted, flower = Skr. क्रीड, Pass. क्रीयते, Pr. विदुद् or विकाद (cf. H. C. 4, 168 वेडु and 4, 382 वेड), H. विकी.
- In Prakrit also the Passive খামন is used, apparently in an active sense; e. g. ভারি "they eat" (Dl. p. 54, quoted from the Mrchchhakatika; R. M. p. 87, seemingly quoting the same, gives খতাৰি).

- 39 बीज or बीभ् be vexed = Skr. बिट्, VI. cl. बिम्दित; but also VII. cl. बिम्ते or IV. cl. बिम्ते, Pr. बिजार (H. C. 4, 224), H. बीजे or (corrupted) बीभे.
- 40 बुख be opened or open = Skr. बुद, Passive बुचते, Pr. बुद्धर or बुद्धर, H बुद्धे. See Nos. 41, 44.*
- 41 बूट pluck = Skr. बाट, Passive बाटाते (actively), Pr. बुहद (H. C. 4, 116, said to be a substitute for Skr. ताडते of root तुड), H. बूट.
- 42 बेख play = Skr. जीड (cp. कीख and बेख), I. cl. जीडित, Pr. चेड्डर (H. C. 4, 188) or बेखर (H. C. 4, 382), H. बेखें. (Pr. also कीखर Dl. p. 47).
- 43 को throw away, lose = Skr. चिष्, VI. cl. चिष्ति, Pr. खिवर, H. बोय् (with को for रव, see my Comp. Grammar, § 122).
- 44 बास open = Skr. बुद् divide, X. cl. बाडयित, Pr. बाडेर or VI. cl. बाडर or बासर, H. बासे. See Nos. 40, 41.
- 45 गड tie = Skr. पंच्, IX. cl. पर्चाति, also I. cl. पन्चति, Pr. गंडर् (H. C. 4, 120), H. गडे.
- 46 गढ़ or गड़ form, grave = Skr. घट, I. cl. घटते, Pr. गडर (H. C. 4, 112), H. गड़े or गड़े. See Nos. 54, 59.
- 47 गढ़ाव् form = Skr. घट, Caus. घाटयति, Pr. मडावेर् or मडावर् (H. C. 4, 340), H. मडावे.
- 48 गन् or गिन् count = Skr. गन्, X. cl. मन्यति, Pr. गनेर् (S. B. 11, 27) or VI. cl. मन्द (H. C. 4, 358), H. गने or (corr.) गिने (see my Comp. Grammar § 35, note).
- 49 गम् be spent = Skr. गम्, Pass. मम्यते, Pr. गमाइ (Vr. 7, 9. 8, 58) H. जमे.
- 50 गरियाय or गिल्याय to abuse = Skr. गई or गल्ड, X. cl. गईशित, Pr. गरिसाय (cf. H. C. 2, 104) or गिल्डायर, E. H. गरिसाय for गरिसाय.
- 51 मज़ melt = Skr. मज़, I. cl. मज़ित, Pr. मज़र (H. C. 4, 418), H. मज़ी
- 52 गर् seize = Skr. घर्, 1X. cl. ग्रहाति, Pr. VI. cl गेंदर (Vr. 8, 15) or गंदर (T. V. 2, 4. 157), H. गर्दे.
- 53 जा sing = Skr. जै, I. cl. गायति, Pr. गाचइ or (contr.) जाइ (Vr. 8, 26), H. जाय्.
- 54 गाइ or गाइ or E. H. गाई form; see secondary roots.
- 55 मिर् fall = Skr. मृ, VI. cl. मिरति, Pr. गिरह, H. मिरी
- 56 मुद्द thread = Sk. मुफ, VI. cl. मुफति, Pr. मुद्द (H. C. 1, 236), H. मर्दे.
- 57 गोच् catch = Skr. मुच् (or गुच), I. cl. मुचति, Pr. गुंचइ, H. गोचे
- 58 ਬਣ decline = Skr. ਬਣ depress, Passive ਬਣੁਤਰੇ, Pr. ਬਣੁਵ, H. ਬਣੈ.
- 59 षड् form, happen = Skr. घट, I. cl. घटते, Pr. घडर (H. C. 4, 112) H. घड़. See Nos. 46, 54.
- * The roots खुल, खोल, खूट are all connected with one another and with the Sanskrit roots चोट. खोट, खोड, खोर, खोल, खुड, खुर्, खुर्, फुर्, which all mean 1, "limp," 2, "divide" or "break." The original form, apparently, is चोट or चर, or rather खुट.

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- 60 बस् or विस् rub, be worn away = Skr. ष्ट्य, I. cl. वर्षति, Pr. VI. cl. वसद (= ष्ट्यति) or विसद (H. C. 4, 204, where it is said to be a substitute of प्रसति), H. वसै or विसे.
- 61 बाज throw, destroy, mix = Skr. यह, I. cl. यहते, Pr. यहार or यहार (H. C. 4, 334, T. V. 3, 4. 6 where it is said to be a substitute of व्यक्ति), H. याजे.
- 62 बुझ or बेह्स mix with a liquid, dissolve = Skr. बुई (also बुझ and बेह्स), I. and VI. cl. घूईति (also बेह्स), मुद्दित, बेह्स बील बेहिंदित), Pr. मुझद्द or बेहिंदि (Vr. 8, 6. H. C. 4, 117), H. मुझे or बेहिंदि (see also Bs. III, p. 56).
- 63 बूस revolve = Skr. बूक्, VI. cl. बूक्ति, Pr. बुकार (H. C. 4, 117), H. बूसे (also Bs. I, 344).
- 64 बेर् gather, surround = Skr. प्रशृ?; compare H. बर house with Skr. स्थ.
- 65 चढ़ mount, increase = Skr. जस-सङ्, VI. cl. जन्दित, Pr. (dropping ज)
 चहुर or चहुर (T. V. 3, 1. 128), H. चढ़े.*
- 66 चप् be abashed = Skr. चप् press, Passive चयाते, Pr. चपर् (see H. C. 4, 395. चिष्यार, T. V. 3, 4, 65. चिष्यार), H. चपे. The transitive form is चाप् or चाँप.
- 67 चर् graze = Skr. चर्, I. cl. चरति, Pr. चरर्, H. चरै.
- 68 चन् or चान् walk = Skr. चन्, I. cl. चन्ति, Pr. चन्द्र or चन्द्र (H. C. 4, 231), H. चन्ने or चान्ने.
- 69 चन् drip = Skr. चु, I. cl. चनते, Pr. चनर् (H. C. 4, 233), H. चने. See No. 74.
- 70 चाब् masticate = Skr. चर्ब, I. cl. चर्वति, Pr. चव्य, H. चार्वे (see also Bs. III, 40.)
- 71 चिंत् think = Skr. चिंत्, X. cl. चिनायति, Pr. चिंतेर (Spt. 156, H. C. 4, 265) or चिंतर (H. C. 4, 422), H. चिंते.
- 72 चिन् gather = Skr. चि, V. cl. चिनाति, Pr. VI. cl. चिक्र (Vr. 8, 29. H. C. 4, 241), H. चिने.
- 73 चुन gather, choose = Skr. चि, V. cl. चिनाति, Pr. VI. cl. चुन्द (H. C. 4, 238), H. चून.
- 74 चू leak = Skr. चुत् (or छुत्), I. el. दोतति, Pr. चोचर् or चुचर् (H. C. 2, 77), H. चूर
- THE lit. fall upwards, an unusual word in Skr., but formed exactly like the common compound THE HT.—The final T of THE becomes T in Pr., see H. C. 4, 130 HET and Vr. 8, 51. H. C. 4, 219 THE. The initial T is dropped, and the aspiration of T transferred to T or lost altogether, just as in the root THE desire, from THE ST. (see my Comp. Grammar § 132). In old H. the root is THE; M. has both THE and THE; but G., S. and B. have THE, which is the form given by H. C. 4, 206 (THE). T. V. 3, 128 gives both THE and

- 75 चूम् kiss = Skr. चुंब्, I. cl. चुन्बति, Pr. चुंबर् (Vr. 8, 71), H. चुने.
- 76 को thatch = Skr. कड़, X. cl. काइयित, Pr. काएइ (cf. Dl. 54) or VI. cl. काक्ट (T. V. 2, 4. 110 or कायद in H. C. 4, 21) or काइ (by contraction; cf. Vr. 8, 26), H. काय.
- 77 विष् or चिष् or कृष् be hidden = Skr. चि dwell secretly, Causal Passive चेयते, Pr. केयद or कियद, H. किये or (corr.) चिये or क्ये.
- 78 की or की क् touch = Skr. स्त्रूम, VI. cl. स्त्रुमति, Pr. विवद् or क्विद (H. C. 4, 182), H. की के or की वे. See No. 80.*
- 79 कीज waste away = Skr. किट्, Passive किश्वते, Pr. किळाइ (H. C. 4, 484), H. कीजे.
- 80 जू or जूच touch = Skr. जुप, VI. cl. जुपति, Pr. जुबह, H. जूरे or जूचे. See No. 78.
- 81 बूट or बुट be released = Skr. बुट cut, Pass. बुटाने, Pr. बुहर, H. ब्हे or ब्हे.
- 82 क्रोड़ release = Skr. चुट Causal चुटयित, Pr. क्रोडेइ or VI. cl. क्रोडर, H. क्रोडे (see also Bs. III, 52).
- 83 जन give birth = Skr. जन्, Causal जनयित, Pr. जचेद् (Spt. 75) or VI. cl. जच्द, H. जने. Skr. also IV. cl. जायते, Pr. जाचद् (H. C. 4, 136), H. deest.
- 84 जप् recite = Skr जन्प, I. el. जन्पति, Pr. जंपर (Vr. 8, 24), H. जपर्
- 85 जर be feverish = Skr. जर, I. cl. जरति, Pr. जरर, H. जरे.
- 86 व्यक् burn = Skr. व्यक्, I. cl. व्यक्ति, Pr. व्यक्तर (H. C. 4, 865), H. वर्जे
- 87 जा go = Skr. या, II. cl. याति, Pr. VI. cl. जाचर or (contr.) जार (H. C. 4, 240), H. जाय.
- 88 जाम or जामर watch = Skr. जाम, II. cl. जामति, Pr. I. cl. जामरइ and VI. cl. जम्मइ (H. C. 4, 80), H. जामरे or जामे.
- 89 जान् know = Skr. जा, IX. cl. जानाति, Pr. VI. cl. जारूर् (H. C. 4, 7), H. जाने, (also Bs. III, 41).
- 90 जी live = Skr. जीव, I. cl. जीवित, Pr. जीवर (H. C. 1, 101), H. जीरे.
- 91 जुक्त् fight = Skr. युघ्, IV. cl. युध्यते, Pr. जुक्कार (Vr. 8, 48), जुक्के (also Bs. I, 328). In old H. also क्रुक्
- * H. C. 4, 182 identifies the roots বিষ্ and বিব্ with Skr. মুখা, for which he gives the Pr. Pass. বিশাহ (H. C. 4, 257). The latter is merely a hardened form of বিশাহ, which would be the regular Pass. of বিশাহ or rather of বিশাহ. Now Skr. মুখা = Pr. বিশাহ or, on account of labial মৃ, = মুখা (see No. 80); again in Pr., মা = মা = আ = আ . Hence Skr. মুখাল = Pr. বিশাহ = বিশাহ = বিশাহ . It follows that the radical forms বিশা and মুখা (H. মা and মুখা are derivative roots, made from the Passives বিশা and মুখা, and that the Skr. root মুখা is merely the Pr. root মুখা in a Skr. dress (cf. Pr. মুখাৰ &c., and see S. Goldschmidt in J. G. O. S. 29, 493).

- 92 जुड be joined = Skr. जुड, Passive जुडाते, Pr. जुइर, H. जुडे; a very old secondary denominative root of यहा p. p. of Skr. root युक्त .
- 93 बोइ join = Skr. जुद, X. cl. बोडयित, Pr. जोडेर or VI. cl. बोडर, H बोड़े,
- 94 मह argue, dispute = Skr. भार, I. cl. भारति, Pr. भार, H. भारे. See No. 96.
- 95 आह or आए fall off = Skr. आह, VI. cl. (आहित), Pr. आहर (H. C. 4, 130 for कहर), H. आहे or आहे. See No. 97.
- 96 জাঁত rush about = Skr. জাত, Passive জাতান (used in active sense), Pr. জাতা (H. C. 4, 161. for জাতা), H. জাতি.*
- 97 फॉ. इ sweep off = Skr. सद्, Causal शादयित, Pr. भाडिर or VI. cl. भाडर, H. भाडे. See No. 95.
- 98 मास् polish = Skr. जस् shine (?), Causal जास्यति, Pr. *भास्ट्र or VI. cl. *भास्र, H. भासे; cf. Skr. भाषा brilliancy, भाषा flame.
- 99 टक or दंद stitch = Skr. टंद, I. cl. टक्ट्रीस, Pr. टंदर, H. टंद or टक्टे. Probably a compound root of ज.
- 100 इंड् or तूड break = Skr. बुड, VI. cl. बुडित, but also IV. cl. बुडिति, Pr. तुइर (H. C. 4, 230) or टुइर (Pingal, as quoted by R. M. p. 99), H. तूड or टुड.
- 101 डब् cheat = Skr. खन्, I. cl. खनित, Pr. डनर्, H. डमे.
- 102 डार् or डाख throw away = Skr. द be scattered, Causal दारयति, Pr. *डारेर् or VI. cl. *डार्र्, H. डारे or डाखे (cf. H. C. I, 217 डरा).
- 103 डॉस् or डास् or डस् bite = Skr. दंश् or इस्, I. cl. दंश्ति or इसति, Pr. डसइ (H. C. 1, 218) or डसइ, H. डॉसे or डासे or डसे.
- 104 डोज़ swing = Skr. दुज़, X. cl. दोज़्यित, Pr. दोज़ेर (H. C. 4, 48) or डोज़ेर (see H. C. 1, 217 डोज़) or VI. cl. डोज़र, H. डोज़.
- 105 डब् cover = Skr. स्थन, Pass. स्थायते (used actively), Pr. उद्घेद, (Spt. A. 54 for उसेद) or VI. cl. उद्घर (H. C. 4, 21, where it
- In B. this root is confounded with wit "sweep." It is closely connected with the root we, the original meaning of which is preserved in Marathi "rush violently into contact with," and in the Hindi we "quickly." Hence it comes to mean, on the one hand, "dispute, argue"; on the other hand, "become intermixed confusedly", "be entangled." With the latter meaning the root we has been received into Sanskrit; from it comes the Skr. Wie "shrub," "underwood," the H. Wie or wis. The original meaning it has preserved in the Skr. Wie "quickly." The root may possibly be derived (as Bs. I, 177 says) from Skr. Wie "quickly." The root may possibly be derived (as Bs. I, 177 says) from Skr. Wie " " though the sense of "roam about very much" would be expressed rather by win + we. But wie for Pass. Wie in act. sense) would regularly give Pr. Wie or Wie or the root wie or wie

is said to be a substitute of ছাত্), H. ভই. (See Wb. p. 43, 64, 67). Perhaps compound root of হয়ৰ-ছা.

- 106 डॉस् accuse = Skr. ? Pr. डंसर (H. C. 4, 118 where it is said to be a substitute for Skr. विद्यत्), H. डॉस. Perhaps a modification of डॉस्, No. 103.
- 107 दुक् approach = Skr. डीक्, I. cl. डीक्से, Pr. दुक्द, H. दुके.
- 108 इंड search = Skr. इंड, VI. cl. बुडात, Pr. बुंडर, H. बुंडे.
- 109 तप burn = Skr. तप, I. cl. तपति, but also IV. cl. तपति, Pr. तपाइ (see H. C. 4, 140 संतपाइ), H. तपे.
- 110 तर् cross = Skr. तृ, I. cl. तरित, Pr. तरद (H. C. 4, 86), H. तरे.
- 111 ताक् attend = Skr. तर्क, X. cl. तर्कयित, Pr. तक्केट्र (H. C. 4, 370) or VI. cl. तक्कर, H. ताके
- 112 तान् stretch = Skr. तन्, Causal तानयित, Pr. ताचेर or VI. cl. ताच्र्, H. ताने.
- 113 तार् save = Skr. तृ cross, Causal तारयति, Pr. तारेर् or VI. cl. तार्र, H. तारे.
- 114 तुम् intrans. weigh, be weighed = Skr. तुम्, Passive तुम्बते, Pr. तुम्रू, H. तुम्रे.
- 115 तोड् or तेर् break = Skr. चट् be torn, Causal चेटियति, Pr. तेरिंड् or VI. cl. तेरिंड (see H. C. 4, 116, where however it is given as intrans.), W. H. तेरिं or E. H. तेरिं.
- 116 तीं ख् or तो ख weigh = Skr. तुख, X. cl. तो खयित or I. cl. तो खित, Pr. तो खेद or तो खुद (T. V. 2, 4. 97), H. तो खे or ती खे.*
- 117 चम् or चन् be arrested, be supported = Skr. संभ्, I. cl. सन्भते, Pr. चमार, H. चमी or चन्हें See my Comp. Grammar § 120.
- 118 बास or बान्द or बान्द or बांस् stop = Skr. स्वांस् be firm, Causal स्वस्मवित, Pr. बंभेइ or VI. cl. बंभइ, H. बांभे, &c.
- 119 श्रोप् pile, prop = Skr. सूप्, IV. cl. सूप्यति, Pr. शुप्पर्, H. श्रोपे.
- 120 दब be pressed down, be cowed = Skr. दम, Passive इस्रते, Pr. इसाइ or *दबाइ, H. दबै (?)
- 121 दक् split = Skr. दक्, I. cl. दक्षित, Pr. दक्षद्र (H. C. 4, 176), H. दक्के.
- 122 इस intrans. burn = Skr. इस, I. cl. इस्ति, Pr. इस्स् (Pingala, as quoted by R. M. p. 113; H. C. 2, 218 allows only ससद; but the root इस् does not occur in H), H. इसे.
- 123 हार्split = Skr. ह, Causal हारवित, Pr. दारेंद्र or VI. cl. दार्द्र, H. दारें.
- * H. C. 4, 25 gives Pr. तुस्ह ; but the root तुस् in a trans. sense does not occur in H., though it is found in M. तुस् or तुळ. In Skr. the root तुस् admits a X. cl. form तुस्पति, from which the Pr. and M. trans. root तुस् is apparently derived.

- 124 दाष् trans. burn = Skr. द्ष्, Causal दाष्यति, Pr. दाचेद् or VI. cl. दाष्ट्र, H. दाष्ट्र, see No. 122.
- 125 दिस् show = Skr. दिश्, VI. cl. दिश्रत, Pr. दिसद, H. दिसे
- 126 दिस or दौस to appear = Skr. हम् see, Passive हम्रते, Pr. दिसाद or दौनद्.(H. C. 3, 161), H. दिसे or दौरे.
- 127 दे give = Skr. दा, Passive दीयते (used actively), Pr. देर (Cw. p. 99, H. C. 4, 238), H. देश or दे. In Pr. also VI. cl. दर (Spt. v. 216), H. doest.
- 128 देख see = Skr. इज्., Future इच्चित (used in sense of present), Pr. देखद (H. C. 4, 181), H. देखे. See introductory remarks.*
- 129 घर् place or seize = Skr. भू, I. cl. घरति (seize) or घरते (place), Pr. घरर (H. C. 4, 284), H. घरे.
- 130 धंस or धस sink, be pierced, run into = Skr. धांस, I. cl. धांसते, Pr. धंस or धसद (Pingala in R. M. p. 118, said to be a substitute for धावात). H. धंसे or धसे.
- 131 चार् hold = Skr. भ, Causal चार्यति. Pr. घरेर or VI. cl. घरर, H. घरे. 132 थे। wash = Skr. चान्, I. cl. घानति (or भू, VI. cl. धुनति), Pr. धोच्चर (Dl. p. 77) or (with euphonic न) धोनर, or भुनर (Spt. v. 133, 283) or भुनर (H. C. 4, 238), H. घोरे or धोने.
- The Skr. conjunct w may in Pr. become wo or w. This will explain the origin of the synonyms of देखार, which are enumerated in H. C. 4, 181; viz., with भ are formed भवभवाद =Skr. भवदस्थाति (from root भव-दम); the same, contracted. becomes with with for we, see H. C. 1, 172); and the latter, expanded, becomes Wasse (with Wa for Wi, see my Comp. Gramm. § 48). With Ware formed अववस्त = Skr. अवदस्यति (for अवस्त्र, with euphonic ए, see H. C. I, 180), and नियम्बर = Skr. निरुद्धाति (from नि-दम्). Again च appears to be softened in which is probably identical with चवचच्च. From the manner in which Hemachandra places पेचर between नियम् and यग्यम् it would almost seem as if he looked upon it as a contraction of पयच्द = Skr. प्रद्धाति (of प्र-हम्). classical Sanskrit the future of TN takes the irregular guna T (instead of TT, see Panini VI, 1, 58); but in the ordinary speech, no doubt, both forms इस्रति and were used. It is the latter of the two, from which the Prakrit forms are derived; thus अव अवस्त्र = अवस्त्र (not = अवस्त्र)=अवद्द्यति. The alternative form of नियम्द would be नियम्बद; this seems to be intended by the form रियम्द in Vr. 8, 69 (with आ disaspirated for अन्). The Pr. पासद is regularly formed from Skr. प्रश्नीत = Pr. प्रसुद् (see Delius Rad. Prac.) or पासद् (H. C. 1, 48); and Pr. चनपासद is the Skr. चनपम्मति. In Maráthí, the Pr. root पास् becomes पार्. The Pr. पुकोरर is derived from Skr. प्रविक्षोक वित (with व्यवि contracted to ৰ, see my Comp. Gramm. § 122); and Pr. ব্ৰাহে is probably a mere corruption of it. None of all these forms, as far as I am aware, has left any representative in modern Hindí.

- 133 बह dance, see secondary roots.
- 134 नव् or नै। intr. bend, bow = Skr. नस्, I. cl. नसति, Pr. नसर् (see H. C. 1, 183, निसस 1. pl.) or नवर् (H. C. 4, 226), H. नवे or नै। ए.
- 135 नवाव or निवाब trans. bend, fold = Skr. नम्, Causal नसयित, Pr. नवावेद or VI. cl. नवावद, H. नवावे or निवाबे (with द for च, see my Comp. Gramm. § 55).
- 136 नहा bathe = Skr झा, II. cl. झाति, Pr. IV. cl. नहायह (cf. Dl. 20) or (contr.) यहाह (H. C. 4, 14), H. नहाय.
- 137 नाच dance = Skr. चत्, IV. el. चत्यति, Pr. नचर् (Vr. 8, 47. H. C. 4, 225), H. नाचे.
- 138 निकास or निकार pull out, see secondary roots.
- 139 निकास expel = Skr. निस्-कस्, Causal निकासयित, Pr. निकासेद or VI. cl. निकासद, H. निकासे; cf. No. 138, the Skr. root कस् being perhaps adopted from Pr. कस् for Skr. क्ष्.
- 140 नियोद् or नियोर् peel; see secondary roots.
- 141 निचर् be cleaned, be peeled = Skr. नि-चर्, I. cl. निचरति, Pr. निकरर, H. निचरे.
- 142 निवार clean, peel = Skr. नि-चर् (or नि-चक्), Causal निचारयित, Pr. निक्वारेद or VI. cl. निक्वारेद, H. निवारे
- 143 निमस swallow; see secondary roots.
- 144 नियार to make clear = Skr. निस्मन, Causal निस्मन्थित, Pr. निसान्धेर or VI. cl. निसान्धर, H. नियार, applied to water, which is made clear by letting it stand still, till the impurities have settled down, and then pouring it off; hence the root has also the meaning "pour off."
- 145 निवड be separated, be decided, be accomplished = Skr. निर्-वड divide, (X. cl. निवंडयित), Pr. निव्यंडर or निव्यंडर (H. C. 4, 62, where it is said to mean प्रवक् साहा वा भवति), H. निवई. It is the pass. or intrans. form of No. 147. The Skr. root is transitive.
- 146 निवाद or निभा accomplish = Skr. निस्वद्, Causal निर्वाद्यति, Pr. निवादे or VI. cl. निव्यादर, H. निवादे or निभाय (with transferred aspiration; see my Comp. Gramm. § 132).
- 147 निवाइ separate, divide, accomplish = Skr. निर्वड divide, Causal निवाटयित, Pr. निवाडेर or VI. cl. निवाडर, H. निवाहै. See No. 145.
- 148 निवेद separate, divide, accomplish = Skr. निर्वंड, I. cl. निर्वंडते, Pr. निर्वंड, H. निवेद (with ए for च, see my Comp. Gramm. § 148). This is merely another form of No. 147.
- 149 निवार hinder = Skr. निन्द, Causal निवारयति, Pr. निवारेड् (H. C. 4, 22) or VI. cl. निवार्ड, H. निवारे.
- 150 निसर् come out = Skr. निस्द, I. cl. निस्तर्रत, Pr. निस्तर्द (see R. M. p. 107; or नीसरद H. C. 1, 93. 4, 79), H. निसर.
- 151 ने।च् pinch = Skr. नि-क्रंच् contract, VI. cl. निकुचति, Pr. निजंबर् H. ने।चे (with चे। for इड).

- 152 प्र be digested = Skr. प्रच digest, Passive प्रचते, Pr. प्रदूर, H. प्रचे.
- 153 पडाब् send = Skr. प्र-स्था, Causal प्रस्थापवित, Pr. पहाबेद् or VI. cl. पहाबद (H. C. 4, 37), H. पडाबे.
- 154 पड़ or पर् fall = Skr. पन्, I. cl. पनित, Pr. पडर (Vr. 8, 51), W. H. पड़े, E. H. परे.
- 155 पढ़ read = Skr. पड़, I. cl. पडति, Pr. पड़र (H. C. 1, 199), H. पड़े.
- 156 परच or परक examine, test = Skr. परि-र्घ, I. cl. परीचने, Pr. परिकार, H. परचे. It also has the secondary meaning "become habituated", owing to repeated trial.
- 157 परच् become acquainted = Skr. परि-चि, Pr. VI. cl. *परिचर्, H. परचे.
- 158 पत्ता or परा run away = Skr. पत्ताच्, I. cl. पत्ताचते, Pr. पत्ताचार or (contr.) पत्तार (Pingala, quoted by R. M. p. 129),* H. पञ्चाच् or पराच्.
- 159 परिसर् forsake = Skr. परि-स, I. cl. परिसर्ति, Pr. परिसर् (H. C. 4, 259 said to be = स्वकृति), H. परिसर्
- 160 परास् offer food = Skr. परि-विष्, Causal परिवेषयित, Pr. परिवेषेर् or VI. cl. परिवेषर, H पराचै (with ची = इवे, see my Comp. Gramm. § 122).
- 161 पसर् be spread = Skr. प्र.स. I. cl. प्रस्ति, Pr. पसर् (H. C. 4, 77), H. पसरे.
- 162 क्लार् spread = Skr. प्र-इ. Causal प्रसारयति, Pr. पसारेइ or VI. cl. पसारइ, H. पसारे.
- 163 परीज perspire = Skr. प्र-सिट्, IV. cl. प्रसिद्धति, Pr. परिचार (see H. C. 4, 224), H. परीज.
- 164 पद्धल stitch = Skr. प्र-सिब्, IV. cl. प्रसीवति, Pr. "पसुकार (perhaps contracted for "पशिविकार्), H. पद्धले.
- 165 पश्चिम् or पिश्चम् cause to put on, cause to dress = Skr. पि-वर्, Causal पिनाश्यित, Pr. पिनश्चिर or VI. cl. पिनश्चर, H. पिश्चमि (with transposition of न and ए) or पश्चिम वे (with transposition of र and ए, see my Comp. Gramm. § 133). See also Nos. 166, 167 for a similar transposition. From this root is formed the derivative root पश्च or पश्चिम put on, dress.
- 166 पहिर put on, dress = Skr. परि-षा, Passive परिषोयने (with active sense), Pr. परिषेद (see Cw. p. 99, sútra 21 घेद) or परिषद (see Wb. p. 59 देद and दूर of root दा) or परिषद, H. पष्टि (with transposition of द and द, see No. 165). This root, however, might be also a derivative root from पिद्राव No. 167. In the Gujarátí form पेदर the द of the second syllable has modified the vowel of the first.
- 167 परिताब cause to put on, cause to dress = Skr. परि-घा, Causal परिधाप-

^{*} पदाउ, I suppose, is a misprint for पदार.

- यति, Pr. परिचावेद or VI. cl. परिचावद् or परिचावद्, H. पिचरावे (with transposition of द and द, as in Nos. 165, 166).
- 168 पहेंच or पहच or पहच obtain, arrive Skr. प्र-भ, I. cl. प्रभवति, Pr. प्रकार or पहच (H. C. 4, 390), H. पहचे or पहचे or पहेंचे. It is formed with the pleonastic suffix जा, like the root चाच, see introductory remarks; only in this case, जा changes to जा and is afterwards disaspirated. Maráthí has पाइंच or पाइंचि, where the ज of the second syllable has modified the first.
- 169 पाइ let fall = Skr. पत्, Causal पातयति, Pr. पाडेर् (H. C. 4, 22) or VI. cl. पाडर् (H. C. III, 153), H. पाई.
- 170 पार् accomplish = Skr. ४, Causal पारवित, Pr. पारेद or VI. cl. पारद (H. C. 4, 86), H. पारे.
- 171 पाइ cherish = Skr. पा, Causal पाइयित, Pr. पाइदि or VI. cl. पाइद, H. पाइ.
- 172 पाय obtain, find = Skr. प्र-चाप्, V. cl. प्राफ्रीति, Pr. VI. cl. पावद् (H. C. 4, 239), H. पावे.
- 178 पिषस् melt = Skr. चपि- or पि-नस्, I. el. चपिमस्ति, Pr. पिनस्त्र् H. पिषस्ति? See my Comp. Gramm. § 131.
- 174 पी drink = Skr. पा, I. cl. पिवति, Pr. पिचर् (H. C. 4, 10), H. पीचे.
- 175 पीच tread down = Skr. पिष्, Future पेच्यति, (with meaning of present), Pr. पेच्द or पिच्द, H. पीचे (with disaspiration, as in चेचे, see introductory remarks, p. 40).
- 176 पीड़ be pained = Skr. पीड, I. cl. पीडते, Pr. पीडइ, H. पीड़े.
- 177 पीस् grind = Skr. पिष्, VII. cl. पिनश्चि, Pr. X. cl. पिसेइ or पीसेइ (cf. Ls. p. 347) or VI. cl. पिंसइ or पीसइ (H. C. 4, 185), H. पीसे.
- 178 पुराब fill, thread = Skr. पू, Causal पूर्यित, Pr. पुराबेद or VI. cl. पुराबद, H. पुराबे (or W. H. also पिराबे in the sense of threading, stringing).
- 179 पूर ask = Skr. प्रह, VI. cl. प्रकृति, Pr. पुक्र (H. C. 4, 97), H. पूर्व.
- 180 पूँच or पेंच् wipe = Skr. प्र-अंच्, I. or VI. cl. प्राव्कृति, Pr. पेंच्यू or पुंच्यू (H. C. 4, 105), H. पेंच्ये or पूँचे.
- 181 पूज worship = Skr. पूज, X. cl., but also I. cl. पूजित, Pr. पूजार, H. पूजी.
- 182 पदर् or पैर् swim = Skr. प्र + तृ, I. cl. प्रतरित or VI. cl. प्रतिरित,
 Pr. पदरद, E. H. पदरे or W. H. पैरे.
- 183 पर्स् or पैस् enter = Skr. प्र-विश्, VI. cl. प्रविश्रात, Pr. पविसर् (H. C. 4, 183) or पर्सर H. पर्से or पैसे.
- 184 पेस squeeze out, shove = Skr. पीड, I. cl. पीडते, Pr. पेसर् (H. C. 4, 143), H. पेसे. See No. 42, खेरी from root जीड. Perhaps a denominative of पिष्ट = पेडू = पेस्ट = पेस.
- 185 पेंच् nourish = Skr. पुच, I. cl. पोर्चात, Pr. पेंचर, H. पेंचे.

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- 186 पढ़ or फाड़ burst = Skr. स्क्रड, Passive स्क्रडाने, Pr. फहर, H. फाडे or फडे.
- 187 पड़ bear fruit Skr. पड़, I. cl. पड़ात, Pr. पड़ाइ (Spt. 17), H. पड़ा, Connected with roots खड़ and पड़; see No. 189.
- 188 पंस or पांच stick, be ensuared = Skr. खुजा, VI. cl. खुजाति, Pr. पंचर or पांचर (H. C. 4, 182, probably denom. of पंच or पांच = सार्ज cf. Vr. 4, 15. H. C. 2, 92), H. पंचे or पांचे. This root is also used transitively, in the sense of "ensuare", "deceive", see H. C. 4, 129, where पंचर is said to be a substitute of विशंवद्
- 189 फाड् cleave, split = Skr. स्क्रड, X. cl. स्क्राडर्शन, Pr. फाडेर् or VI. cl. फाडर् (H. C. 1, 198. 232), H. फाडे. Hemachandra refers it to root पड, X cl. पाडर्थान.
- 190 पाइ jump = Skr. सांद shake, Causal सादयति, Pr. पांदेर or VI. cl. पंदर, H. पांदे. Observe the same transition of meaning as in No. 191. It is also used transitively, in the sense of "ensnare", "imprison", corresponding to the intransitive root पांद, see secondary roots. H. C. 4, 127 gives पांदर in its original sense of "shaking", "quivering" = Skr. सांदते; its synonym पुलुक्तर, which H. C. also gives, still exists in H. पुलुक्त or पुलुक्तर, which H. C. क्ष्म पुले or पुलुक्तर, "he is fidgety."
- 191 पान jump = Skr. साम shake, Causal स्वामयित, Pr. पानेद or VI. cl. पानेद, H. पाने. Probably connected with root No. 189; H. C. 4, 198. 232 give फानेद as an other form पानेद.
- 192 फिड be paid off, be discharged = Skr. स्किइ, X. cl. स्किइयति, Pr. फिइइ (H. C. 4, 177, said to be = अंग्र् "cease", "decline"), H. फिड; cf. R. सक्ड and सक्ड.
- 193 पुढ or पुढ expand, increase, be broken, be dispersed = Skr. खुढ, Passive खुढाते, Pr. पुढ़र (Vr. 8, 53. H. C. 4, 177, where it is said to be a substitute of भंग, in the sense of "being broken"), H. पुढे or पुढे. See No. 194.
- 194 पुछ or पूछ blossom = Skr. खुट, VI. cl. खुटित, Pr. पुट्ट or पुडर (Vr. 8, 53) or पुछर (H. C. 4, 387 whence Skr. R. पुछ adopted), H. पुछ or पूछे. See No. 193.
- 195 फेर् or फिर्turn, move round = Skr. परि + इ. II. cl. पर्वेति, Pr. फेरेइ or फेर्ट (with change of प to प and of चर्य to एर, as in पेरंते। for पर्यतः), H. फेरे.
- 196 पेंच spread, be dispersed = Skr. स्थिड, X. cl. स्थेडयित, Pr. फेडेर् or VI. cl. फेडर् (H. C. 4, 358; in H. C. 4, 177 the simple form फिडर् is given as a substitute of भेग्) or फेडर् (whence Skr. R. फेड्), H. फेडे See Nos. 189, 192, 193; the original meaning "split", hence "expand", may change either to "increase" or to "decrease", to growth or to decay.

- 197 फो unfasten = Skr. प्रमुख, VI. cl. प्रमुखित, Pr. प्रमुखद (cf. H. C. 4, 91), H. फोरे (for पोरे = पडरे).
- 198 फोड़ break = Skr. स्फुट, Causal स्फोटयित, Pr. फोडेर (H. C. 4, 350) or VI. cl. फोडर, H. फोड़े.
- 199 वस् go away, escape = Skr. त्रज्, I. cl. त्रजति, Pr. वसद् (Vr. 8, 47), H. वस. More likely from root वस्, or from Pass. इत्यते of Skr. R. इत.
- 200 बज् or बाज् sound = Skr. बद्, Causal Passive बाचते, Pr. बजाद (H. C. 4, 406), H. बजा or बाजे.
- 201 वस् be enenared = Skr. वध्, Passive वधाते, Pr. वच्यार (H. C. 2, 26. 4, 247), H. वर्धे.
- 202 बढ tr. and intr. twist, divide = Skr. बढ, Passive बटाते, Pr. बहुद, H. बढे.
- 203 बढ़ or E. H. बाई grow = Skr. इध्, I. cl. बर्बते, Pr. बहुद (Vr. 8, 44), H. बढ़ or E. H. बाई.
- 204 बडाव enlarge, complete = Skr. डघ, Causal वर्षेश्वति, Pr. बड़ावेर or VI. cl. बड़ावर, H. बडावे. (T. V. 3, 1. 132 has बड़ाविचं = समापितं).
- 205 बताब् show, relate = Skr. छत्, Causal बर्त्तबति, Pr. बताबेइ or V1. cl. बताबद, H. बताबे.
- 206 वस् kill = Skr. वस् (or बास्, I. cl. बासते), Pr. वसर, H. वसे.
- 207 वन् be made Skr. वन्, Passive वस्त्रे, Pr. वचर, H. वने. In Sindhí it means "go, come," cf. the Mágadhí वस्त्रीं (H. C. 4, 294) which the Prákrit Grammarians derive from the Skr. R. बस्त go or become.
- 208 बर् marry = Skr. इ. V. cl. इचोति, but also I. cl. वरति, Pr. वरद (Vr. 8, 12), H. वरे.
- 209 बरिस् or बर्स् rain = Skr. हब्, I. cl. वर्षति, Pr. वरिसद् (Vr. 8, 11.; perhaps denom. of वर्ष), E. H. वरिसे or W. H. वर्स.
- 210 वस् burn == Skr. जस्, I. cl. जस्ति, Pr. वस्तर् (H. C. 4, 416 वस्ति), H. वस्ते.
- 211 वस् dwell = Skr. वस्, I. cl. वस्ति, Pr. वसर, H. वसे.
- 212 वर् flow = Skr. वर्, I. cl. वर्षत, Pr. वर्द (H. C. 1, 38), H. वर. The root वर्स glide happily, be diverted is a passive or intrans. of a causal वरसाव formed like पिसाब from पीय drink.
- 213 in recite, read; see secondary roots.
- 214 बॉब् wish = Skr. बॉब्, I. cl. बाक्क्ति, Pr. बॉक्स (T. V. 3, 1. 183), H. बॉब्स
- 215 बांघ bind = Sk1. बंघ, IX. cl. वधाति, Pr. VI. cl. वंधर् (H. C. 1, 187), H. बांघे.
- 216 बाझ or बार् kindle, light = Skr. जल, Causal चासुयित, Pr. वासेर or बासुर, W. H. बासे or E. H. बारे. See No. 210.
- 217 वास् perfume = Skr. वास्, X. cl. वासयित, Pr. वासेइ or VI. cl. वासइ, H. वासे.

- 218 विक् be sold = Skr. वि-क्री sell, Passive विक्रीयते, Pr. विकेद or विकाद, H. विकेद (see Vr. 8, 31. H. C. 4, 240, where however the form विकेद is given as act. trans; in the moderns it is intrans. or pass., and the trans. root is विच, cf. No 242.
- 219 विवड़ or E. H. विवर be at variance, be spoiled = Skr. वि-चड, I. cl. विचडते, Pr. विवडह (cf. H. C. 4, 112), H. विवड़ (for विवड़). See No. 46.
- 220 विजाइ make discord, spoil = Skr. वि-वह, Causal विधादयित, Pr. विजाहेरू or VI. cl. विजाहर, H. विजाहेर (for विजाहेर). See No. 54.
- 221 विचार reflect = Skr. वि-चर्, Causal विचारयति, Pr. विचारेद् or VI. cl. विचार्द, H. विचारे.
- 222 विसर् scatter Skr. वि-दू, IX. cl. विस्कृति, Pr. I. cl. विस्तर् (cf. No. 102), H. विस्तर.
- 223 विकार drive away = Skr. वि-इ, Causal विदारयति, Pr. विकारेद or VI. cl. विकारद, H विकारे. See No. 102.
- 224 वितर् grant = Skr. वि-तृ, I. cl. वितरित, Pr. वितर्, H. वितरि
- 225 विचार tr. spread = Skr. वि-स, Causal विसारयति, Pr. विसारेद or VI. cl. विसारद, H. विचारे.
- 226 facta mock; see secondary roots.

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- 227 विस्तृ or विस्तृ see, be confused = Skr. वि-सृच्, X. cl. विस्तृ चयित, Pr. विस्तृ को VI. cl. विस्तृ का (corrupt) विस्तृ .
- 228 विस्तृ intr. separate = Skr. वि-स्तृ, Passive विस्त्रायते (with active sense), Pr. विस्त्रायद् (cf. Vr. 8, 52), H. विस्तृते,
- 229 विसंग् ascend = Skr. वि-संघ्, L. cl. विसंग्रित, Pr. विसंघर, H. विसंग्रे (for विसंग्रे).
- 230 विद्यम् be pleased = Skr. विन्तुम्, I. cl. विद्यमित, Pr. विद्यमर्, H. विद्यमे.
- 231 विद्याव tr. and intr. disperse, vanish = Skr. विन्ही, Causal विद्यापयित, Pr. विद्यावेद or VI. cl. विद्यावेद, H. विद्यावे.
- 232 विसर् enjoy one's-self = Skr. वि-स्, I. cl. विसर्ति, Pr. विसर् (H. C. 4, 259 where it is said to be a substitute of Skr. क्रीडित), H. विसरे.
- 233 विडाय् or विद्या leave, spend = Skr. वि-द्या, III. cl. विद्याचीत, Pr. I. cl. विद्याचार or विद्यायार or (contr.) विद्यार, H. विद्याय or विद्यायार or कि. Vr. 8, 26.
- 231 विसर् forget = Skr. विस्तृ, I. cl. विस्तरति, Pr. विसर् (cf. H. C. 4, 74), H. विसरे.
- 235 बीम tear, break up Skr. भिन्न, Passive भिन्न (used actively), Pr. भिन्न, H. बीम (for भीन, with aspiration transferred; see my Comp. Gramm. § 132), or perhaps Skr. अध्, IV. cl. विधात, Pr. विकाद, H. बीम.
- 236 बीत pass; see secondary roots.
- 237 बीम or बिम् choose = Skr. बी, IX. cl. बीचाति or बिचाति, Pr. VI. cl. वीचर or बिचर. H. बीचे or बिने.

- 238 बुक्त be extinguished = Skr. वि-चव-चै, I. cl. ववचार्यात, Pr. वेडिक्ट्रेड् or वेडिक्ट्र (or दु॰), H. बुक्टें. See Weber Spt p. 32.*
- 239 बुद्ध or बुद्ध dive, sink = Skr. बुद्ध, VI. cl. बुद्धित Pr. बुद्धुद्ध (H. C. 4, 101), H. बुद्धे or बुद्धे or W. H. transposed दुन्दे or दुने.
- 240 बृत् be extinguished = Skr. वि-मा-दृत् come to an end, I. cl. बाःतते, Pr. व वनद् or वोत्तद् or बुत्तद्, H. बुते. Compare H. बत्ती = बर्तिका light, lit. wick.
- 241 बुहार् gather, sweep = Skr. वि-खव-ह, Causal खनहारवति, Pr. वोहारेड् or VI. cl. वोहारड्, H. बुहारे.
- 242 बृक्ष understand = Skr. बुक्, IV. cl. बुक्त, Pr. बुक्कइ (Vr. 8, 48), H. बक्ते
- 243 बेच् sell Skr. बच् cheat, VI. cl. विचित्त, Pass. बचते (used actively), Pr. वेचर् (H. C. 4, 419, T. V. 3, 3. 4, transl. प्रवक्ति?), E. H. बेच्; or perhaps Skr. वि-चित्त + र् spend, II. cl. बारोति, Pr. वेचर् or वेचर्?
- 244 se surround; see secondary roots.
- 245 वैस् or वर्स sit = Skr. जप-विज्ञ्, VI. cl. जपविज्ञति, Pr. जवविसद् H. वर्से or वैसे (with loss of initial ज, see my Comp. Gramm. § 173).
- 246 वे। sow = Skr. वप्, I. cl. वपति, Pr. वावद् or वाचद् (formed like सेवद् of खप्, H. C. 1, 64), H. वे।ए.
- 247 बाड् immerse = Skr. बृड्, Causal ब्राडधित, Pr. बाडेड् or VI. cl. बाडिड्, H. बाडे.
- 248 बोज्ञान् or बुज्ञान् or बज्ञान् call = Skr. बद्, Causal बाद्यसि, Pr. बोज्ञानेद् or VI. cl. बोज्ञानद्द, H. बोज्ञाने, &c. See No. 249.
- 249 बोध् wheedle = Skr. बुध्, Causal बोधयित, Pr. बोधेर् or VI. cl. बोध र, H. बोधे.
- 250 बोस speak = Skr. वद्, I. cl. वद्ति, Pr. बोस्तर (H. C. 4, 2.) or वोस्तर (Cw. 99), H. बोर्स. (cf. No. 245 वप् = बोव्, so वद् = बोस्).†
- * The simple root ত would form Pr. সামা and contracted সাহ, after the analogy of তামাই, তাই from আ, সামাই or সাই from আ (Vr. 8, 26); this is born out by Páli স্বায়নি, and by Pr. বিভাগাই (H. C. 2, 28 = Skr. বি-আয়নি); but in compounds the Pr. form might be সাই or সাই, just like তাই or তাই in ডাইই, ডাইই form ডান্ + আ (H. C. 4, 17); thus we should have regularly আডাইই or (as o is short before a conjunct) ব্ৰামাই, ব্ৰামাই.
- † This root is usually connected with Skr. बढ् by Prakrit Grammarians, see Cw. p. 99, where वेश्वर or वेश्वर, of root वच्, is mentioned as an analogous formation. Now the latter is derived from the passive "तुचते (उचते), in an active sense, as appears from H. C. 4, 161. Similarly, I am inclined to derive वेश्वर from the passive *ब्येसे (for प्रयस्ते of root व्र.), used actively. The conjunct ये becomes ज, as in प्रवार्थ = पर्यार्थ, योजनार्थ = पर्यार्थ,

- 251 मच eat, devour == Skr. सच, I. cl. सचति, Pr. मक्दर, H. भवे.
- 252 मज worship = Skr. मज्, I. cl. भजति, Pr. भजर, H. भजे.
- 253 मज or भाज flee Skr. भंज break, Passive भज्यते (used actively), Pr. भज्जद, H. भजे or भाजे.
- 254 संख् break Skr. संख्, VII. cl. सर्वास, Pr. VI. cl. संख्यू (H. C. 4, 106), H. संब
- 255 मन् speak = Skr. सच्, I. cl. सचित, Pr. सच्दू (H. C. 4, 239), H. सनै.
- 256 सर् fill = Skr. स्, III. cl. विभक्ति and I. cl. भरति, Pr. भरह (cf. Spt. 288 भरति). H. भर.
- 257 मन् or भा revolve = Skr. भम्, I. cl. भमति, Pr. भमद् (H. C. 4, 161) or भनद् (cf. H. C. 4, 401), H. भने or भारे. See No. 134 नन् or ना.
- 258 मंस् float = Skr. क्षंत्र, I. cl. क्षंत्रते, Pr. संसद, H. अंसे.
- 259 मास see Skr. मस्, X. cl. भास्तवते, Pr. भारेड or VI. cl. भास्त, H. भासे.
- 260 बाच appear = Skr. बाच, I. cl. भावते, Pr. भावद (H. C. 4, 203), H. बाचे. Pr. has also the form भिचद which is preserved in the Hindi root बिचच dazzle.
- 261 भीज be afflicted Skr. सिंदू break, Passive भिद्यते, Pr. भिज्यार, H. भीजे. See No. 234. Or from चिंत-चर्द afflict, Pass. चार्यचेते, Pr. चिंग्चार, H. भीजे (with loss of च, see my Comp. Gramm. § 172).
- 262 भी be wet; see secondary roots.
- 263 भूंक cat = Skr. भुक्, VII. cl. भुक्ति, Pr. VI. cl. भृंबद (H. C. 4, 110), H. भुक्ते.
- . 264 wa fry; see secondary roots.
 - 265 No close, for as with transposed aspiration, see No. 244.
 - 266 मेर meet, visit = Skr. जांस-जार, I. cl. जांसरति, Pr. जांसर, H. भेडे (with loss of initial ज; and with ए for ए; see my Comp. Gramm. §§ 148, 172).
 - 267 सच् be raised up, be made, be stirred up, be excited = Skr. संच् or सच्, Passive सच्यों, Pr. सच्छ (H. C. 4, 230 where it is referred to the Skr. root सङ्), H. सचे. From it are derived many Hindí nouns, all meaning lit. "an erection", साचा or सचान or सचाना a large bedstead or stage, सचिय a small bed, stool, सच् drowsiness; also many secondary roots, as सचाच creak in the joints (as a bedstead, &c.), सच्च creak or pain in the joints, सच्चाच wink, सच्च or सच्चाच be fidgety, be perverse, feel nausea.
 - 268 संख् clean = Skr. खन्, II. cl. साहि and I. cl. सञ्जति, Pr. संगर् (whence Skr. R. संग X. cl.), H. संगे.
 - 269 HE cover = Skr. EE; see secondary roots.

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- 238 बभा be extinguished = Skr. वि-चव-चै, I. cl. ववचायित, Pr. वेक्किंद or बेक्किंद (or बु॰), H. बुभो. See Weber Spt. p. 32.*
- 239 बुद or बुद dive, sink = Skr. बुद, VI. cl. बुद्धित Pr. बुदुद (H. C. 4, 101), H. बुद्धे or बुद or W. H. transposed दुवे or दुवे.
- 240 बुत् be extinguished = Skr. दि-चा-दृत्त come to an end, I. cl. आ श्रांति,
 Pr. व वत्तद् or वोत्तद् or बुत्तद्, H. बुति. Compare H. बत्ती = वर्तिका
 light, lit. wick.
- 241 बुहार gather, sweep = Skr. वि-खव-ह, Causal खन्डारवित, Pr. वोहारेद्र or VI. cl. वोहारद, H. बुहारे.
- 242 बुभा understand = Skr. बुभ, IV. cl. बुभाते, Pr. बुक्सइ (Vr. 8, 48), H. बभी
- 243 वेच् sell Skr. बच् cheat, VI. cl. विचित्त, Pass. बच्चते (used actively), Pr. वेचर् (H. C. 4, 419, T. V. 3, 3. 4, transl. प्रयक्ति?), E. H. वेच्; or perhaps Skr. वि-चित्त + र् spend, II. cl. बत्येति, Pr. वेचेर् or वेचर्?
- 244 se surround; see secondary roots.
- 245 वैस् or बस् sit = Skr. जप-विम्, VI. cl. जपविम्नित, Pr. जवविसद् किर् H. बर्से or बेसे (with loss of initial ज, see my Comp. Gramm. § 173).
- 246 वे। sow = Skr. वप्, I. cl. वपित, Pr. वावद् or वासद् (formed like शेवद् ः क्ष
- 247 बाड् immerse = Skr. ब्रुड्, Causal ब्राडयति, Pr. बाडेर् or VI. cl. बाडर् H. बाडे.
- 248 बोझाव् or बुझाव् or बुझाव् call = Skr. बद्, Causal बाद्यति, Pr. बोझावेश का VI. cl. बोझावद, H. बोझावे, &c. See No. 249.
- 249 बोध् wheedle = Skr. बुध्, Causal बोधयित, Pr. बोधेर् or VI. cl. बोधंं व H. बोधे.
- 250 बास speak = Skr. बद, I. cl. बदित, Pr. बासद (H. C. 4, 2.) or बास कि (Cw. 99), H. बासि. (cf. No. 245 वप = बाब, so बद = बास). †
- The simple root च would form Pr. आचर and contracted भार, after the analogy of डाचर, डाइ from खा, आचर or आद from खे (Vr. 8, 26); this is bo out by Páli भायति, and by Pr. विकार (H. C. 2, 28 = Skr. विचायति); but compounds the Pr. form might be अद or अद, just like उद्देश उद्देश कर विचायति।

 form जत्म खा (H. C. 4, 17); thus we should have regularly बाउमोर or (as o is she before a conjunct) बुउमोर, बुउमोर.
- † This root is usually connected with Skr. बढ़ by Prákrit Grammarians, see C p. 99, where वीचर or वीचर, of root बच, is mentioned as an analogous formation. N the latter is derived from the passive बच्चेत (उच्चेत), in an active sense, as apperation H. C. 4, 161. Similarly, I am inclined to derive वाचर from the passive क्येत (उच्चेत), used actively. The conjunct ये becomes ज, as in प्रवाच = पर्याच । जिल्ला में (Vr. 3, 21).

- 251 म् eat, derowe = Skr. अच्, I. cl. सचति, Pr. अक्दर, H. अवे
- धि भव vorskip = Skr. अव्य, I. cl. अव्यति, Pr. अव्यद्, H. अव्य
- 23 भव or साव flee = Skr. संज break, Passive सव्यते (used actively), Pr. सव्यद, H. सर्वे or सावे.
- 254 मंत्र break Skr. अंख, VII. cl. अवित्त, Pr. VI. cl. अंखद (H. C. 4, 106), H. भंज.
- 255 मन् speak = Skr. सक्, I. cl. सकति, Pr. सक्द (H. C. 4, 239), H. सब.
- 256 मर् fill = Skr. स्ट, III. cl. विभक्ति and I. cl. भरति, Pr. सरह (cf. Spt. 288 मर्राव), H. सर.
- 257 भर or भी revolve = Skr. धन, I. cl. धनति, Pr. समद (H. C. 4, 161) or भनद (cf. H. C. 4, 401), H. भने or भारे. See No. 134 वर् or नी.
- 258 मंस् float = Skr. संभ, I. cl. संभत, Pr. मंसर, H. भंसे.
- 259 मास् क्ट = Skr. मस्, X. cl. भास्त्रवते, Pr. भारे द् or VI. cl. भास्त्र, H. भासे.
- अध्य appear = Skr. भास, I. cl. भासते, Pr. भासद (H. C. 4, 203), H. बासे. Pr. has also the form भिसद which is preserved in the Hindi root श्रिसस dazzle.
- 261 बीज् be afflicted = Skr. भिद् break, Passive भिद्यते, Pr. भिकार, H. भीजे. See No. 234. Or from चिभ-चर्द afflict, Pass. चअर्थते, Pr. चिम्बर, H. भीजे (with loss of च, see my Comp. Gramm. § 172).
- be wet; see secondary roots.
- ्रेंब् cai = Skr. भुज, VII. cl. भुवित्त, Pr. VI. cl. भुवित् (H. C. 4,
- If fry; see secondary roots.

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- see No. 244.
- with loss of initial प; and with ए for ए; see my Comp. Gramm.
- Passive अवते, Pr. अवर (H. C. 4, 230 where it is referred to the Skr. root अद्), H. अवे. From it are derived many Hindi nouns, all meaning lit. "an erection", आचा or अवाव or अवाव a large bedstead or stage, अविव a small bed, stool, वर्ष के drowsiness; also many secondary roots, as अवस्य creak in the joints (as a bedstead, &c.), अवद creak or pain in the joints, वर्षांत्र sink, अवस् or अववाव be fidgety, be perverse, feel
- के हिंद = Skr. स्व, II. cl. मार्ड and I. cl. सञ्चति, Pr. संजर (whence Skr. R. संब X. cl.), H. संबे.
- Skr. चह ; see secondary roots.

- 270 सन् be propitiated = Skr. सन्, Causal Passive सान्वते, Pr. सन्नर, H. सने. See No. 277.
- 271 नर् die = Skr. च, VI. cl. चियते, but Vedic also I. cl. नरति, Pr. नरद (Vr. 8, 12), H. नरे.
- 272 मस् rub = Skr. सद्, IX. cl. सद्ग्रांत Pr. VI. cl. मस् (Vr. 8, 50), H. मसे.
- 273 नइ churn = Skr. नव्, I. cl, नवति, Pr. नइइ (cf. Dl. 53), H. नई.
- 274 कान ask for = Skr. कार्न, X. cl. बार्नेयति and I. cl. कार्गति, Pr. सम्बद्ध (Spt. 71), H. समी. Cp. Skr. R. खन्, IV. cl. खम्यति, which would give the Pr. सम्बद्ध equally well; but the denom. R. कार्ने is the more probable source, as Pr. and Gaud. have a preference for denominative verbs.
- 275 सैंग्ज् scour = Skr. सार्ज्, X. cl. सार्जयित (or R. सज्, X. cl. सार्जयित, see remarks on No. 274), Pr. संजेद्द or VI. cl. संजद, H. साँजे.
- 276 माँड् or माड् rub = Skr. चड्, IX. cl. चड्राति or I. cl. मर्दति, Pr. मच्ड्र (H. C. 4, 126), H. माडे or माडे.
- 277 सान् honor, heed = Skr. सन्, Causal सानयित, Pr. सानेइ or VI. cl. सानइ, H. साने, See No. 270.
- 278 साप or जाप measure = R. सा, Causal Passive सापाते (used actively), Pr. सापाइ, H. सापी. The form जाप is either a mere corruption of साप, or it may be similarly derived from the Causal Passive चापाते (of root जा), Pr. जपाइ, H. जापी.
- 279 सार् beat, kill = Skr. मृ, Causal सार्थति, Pr. सारेइ (H. C. 4, 337) or VI. cl. सार्इ (H. C. 3, 153), H. सारे.
- 280 सिन् meet = Skr. सिन्, VI. cl. सिन्ति, Pr. सिन्त् (H. C. 4, 832), H. सिन्ते.
- 281 तिस् be pulverised = Skr. सम्, VI. cl. सम्ति, Pr. तिसर्, H. निर्दे.
- 282 सीच् or सीच् wink = Skr. सिच्, future नेम्ब्रित (used in sense of present), Pr. सेम्ब्र्ट or सिम्ब्र्ट, H. सीचे or (corrupt) सीचे. See introductory remarks pp. 37—40, and No. 175.
- 283 भी ज or भीज rub = Skr. सज, II. cl. साष्टि or I. cl. सञ्चति, Pr. निजर, H. भी जे or भीजे.
- 284 मूंड shave = Skr. मुंड, I. cl. मुख्ति, Pr. मुंडर (H. C. 4, 115), H. मूंड.
- 285 मूच steal = Skr. मूच, I. cl. मूचित, Pr. मूचइ (T. V. 2, 4. 69), H. मूचै.
- 286 मीच allure = Skr. मुच्, Causal माच्यति, Pr. माचेद् or VI. cl. बाचद, H. माचे.
- 287 रच् keep, place = Skr. रच्, I. cl. रचति, Pr. रक्बर् (H. C. 4, 439), H. रचे.
- 288 रच् intr. be made or tr. make = Skr. रच् make, Passive रचते (used actively), Pr. रचर (cf. H. C. 4, 422, 23 रचित्र. Spt. 363 रिचय = रचित्र), H. रचे.

- 289 रस् roam, enjoy = Skr. रस्, I. cl. रसते, Pr. रसर् (H. C. 4, 168), H. रसे.
- 290 र stop, remain = Skr. रच्, Passive रचाते Pr. रचनर, H. रचे (for रचे)*
- 291 राज् be adorned = Skr. रंज or रज्, IV. cl. रचति, Pr. रजार, H. राजे
- 292 राष् or री घ cook = Skr. रथ, Causal रअवति, Pr. रंधेइ or VI. cl रंधइ, H. राष्ट्रे or (corr.) री थे.
- 298 रिष् be vexed = Skr. रिष्, IV. cl. (or Pass.) रिष्यते, Pr. रिसार, H. रिफ.
- 294 रच be agreeable = Skr. रच, Passive रचते, Pr. रचर (H. C. 4, 341), H. रचे.
- 295 वर्ष intr. be fixed, stop = Skr. वर्, Causal Passive राष्ट्रते, Pr. राष्ट्र or वयद, H. वर्षे.
- 296 वस् or इस् be angry = Skr. वस्, IV. cl. वस्ति, Pr. वस्त् or इस् (Vr. 8, 46), H. वसे or इसे; cf. No. 302.
- 297 to or to or to or to trample on, probably a corrupt spelling of the following, No. 298.
- 298 बंध or केंच or रोंघ or रोंघ enclose, restrain = Skr. वच , VII. cl. वचि,
 Pr. बंधद (Vr. 8, 49), H. वंधे or केंग्रे or रोंग्रे
- 299 र्ब creep = Skr. रिंग, I. cl. रिंगति, Pr. रिंगइ or रियाइ (H. C. 4, 259), H. रेंगे.
- 800 रो weep = Skr. बद. II. cl. रोदिति, Vedic also VI. cl. बदित. Pr. बबद् (H. C. 4, 226. 238) or बबद् (Spt. 311) or I. cl. रोबद् (H. C. 4, 226. 238) or रोबद् (K. I. 4, 69), H. रोबे or रोपे.
- 301 रोख् roll, plan = Skr. जुड़, I. cl. जोख़ित, Pr. जोख़र, H. रोखें.† See Nos. 313, 314.
- 302 राष् be angry = Skr. रण्, Vedic I. el. राणित, Pr. राजर, H. रापि; ef. No. 296.
- 303 सुब् see = Skr. सुच्, I. cl. सुचते, Pr. सुक्दर, H. सुचै.
- 304 इस be applied = Skr. इस, Passive इस्पत, Pr. इस्पाइ (Vr. 8, 52), H. इसी.
- 305 सुंच् or सांच् jump over = Skr. सुंघ्, I. el. सुंघति, Pr. सुंघर्, H. सुंघे or सांचे.
- 806 सुदू or E. H. सुद् dispute, fight = Skr. सुद, X. el. सुद्यति, Pr. सुदेर
- The derivation is somewhat obscure; but it can hardly be referred (as Bs. III, 40) to the Skr. root \(\times\) which has a very different meaning "desert". The derivation from \(\times\) is supported by the Maráthí form \(\times\). On the change of \(\times\) to \(\times\), see my Comp. Gramm. § 116.
- † There is a large number of Skr. roots, all closely connected in meaning; vis. बढ, बढ, रोड, रोड, खुड, खुड, खुड, कोड, &c.

or VI. cl. खडर, W. H. खड़े or E. H. खरै.

- 307 खन् or जान् shine, be fit = Skr. जन, I. cl. जनति or X. cl. जान्यति,
 Pr. जन्द or जान्द, H. जन्दै or खाने.
- 308 जब् find, avail, get on well = Skr. जुन, I. cl. जुनते, Pr. जुन्द (H. C. 4, 335), H. जुनै.
- 309 ज्ञान feel ashamed = Skr. जुन्ज, I. cl. जुन्जति, Pr. जुन्जर् (H. C. 4, 103), H. ज्ञान
- 810 ज़िन् write = Skr. ज़िन्, VI. cl. ज़िन्ति, Pr. जिन्द, H. ज़िन्दे The ordinary Pr. root ज़िन् (H C. 1, 187 ज़िन्द्) does not exist in Hindí.
- 811 जिए be smeared = Skr. जिए, Passive जिएते, Pr. जिएद. H. जिएै
- 812 जीप or जेप smear = Skr. जिए, VI. cl. जिन्मित, Pr. जिंपर (H. C. 4, 149), H. जीप or जेप. As to the change of र to ए, see my Comp. Gramm. § 148.
- 813 जुड़ roll = Skr. जुड़, VI. cl. जुड़ित, Pr. जुड़र, H. जुड़े. See Nos. 301, 314, 317.
- 314 सृष् roll = Skr. सृड, VI. cl. सृडति, Pr. सृडर्, H. सृड्.
- 815 जूट or जूट *rob* = Skr. जुंट or जुंट I. cl. जुंद्धति or जुंद्धति, Pr. जुंटर or जुंटर, H. जूट or जूटे.
- 316 से take = Skr. सुभ, I. cl. सुमते, Pr. सुद्द or सेंद्र (H. C. 4, 238), H. सेंग् or से. The syllable सुद्ध is contracted into से; similarly कर speak is sometimes pronounced के, and सुद्ध bear, से.
- 317 स्रोड roll about = Skr. स्ड, VI. cl. सुटाति, Pr. साहर (H. C. 4, 146 in the sense "rolling about in sleep"), H. स्रोड.
- 318 खोभ be enamoured = Skr. खुभ, IV. cl. खुभित, Pr. खुभ्भद (H. C. 4, 153), H. खोभै. As to the change of w to चा, see my Comp. Gramm. § 148.
- 819 बार् surround = Skr. ह, Causal बारचित, Pr. बारेंद्र or VI. cl. बार्द्र, H. बारे.
- 320 सक् can = Skr. म्ब, Passive म्बाते (used actively), Pr. समूद् (Vr. 8 52), H. सबै.
- 321 संवार or संसार् (or समार्) destroy = Skr. सम्सू, Causal संसारयित, Pr. संसारेद् or संवारेद् (cf. H. C. 1, 264) or VI. cl. संसारद or संवारद, H. संवारे or संसारे (or समारे). Or a denominative of संसार.
- 322 संस् collect = Skr. सम् चि, Passive संसीयते (used actively), Pr. संसेद (cf. H. C. 4, 241 जबेद) or VI. cl. संस् (as जहुद् for जहेद्द), H. संसे.
- 823 चंड् or चड् be combined = Skr. चन्-खा, Passive चंखीयते (used actively), Pr. चंडेर् or VI. cl. चंडर् (like चहेर् and चहर), H. चंडें or (corr.) चडे.

- 1890.] **324 चब्**
 - 324 सब् or सर् rot = Skr. सब् (or मब्), I. cl. सीदति, but Vedic also सदित, Pr. सबद् (H. C. 4, 219; in Vr. 8, 51 it is ascribed to मब्), W. H. सब्दे or E. H. सरे.
 - 325 सताव persecute, torment = Skr. सम्तप्, Causal सन्तापयति, Pr. संतावेद् or VI. cl. संतावद. H. सतावे.
- 326 सद् leak = Skr. संद्, I. cl. सान्तो, Pr. मंदर, H. सहै. As to elision of the nasal, see my Comp. Gramm. §§ 143, 146. See No. 353.
- 327 संभाज or संदाज or समाज sustain = Skr. सम्-४, Causal सभारयति, Pr. संभारेद or VI. cl. संभारद H. संभाज, &c. Or demon. root of सभार.
- 328 समाव be contained = Skr. सम्-चाप्, V. cl. समाप्नाति, Pr. X. cl. समावेद्द H. C. 4, 142) or VI. cl. समावद्द, H. समावे See No. 172.
- 329 समृत्र or समृत्र understand = Skr. सम्बुध, IV. cl. सन्बुधते, Pr. संबुद्धभार, E. H. समृत्र or W. H. समृत्र See No. 242.
- 330 सर् issue, be ended = Skr. इ. I. cl. सरति, Pr. सरह (Vr. 8, 12), H. सरे.
- 331 सराष्ट्र commend = Skr. स्नाम, I. cl. स्नामते, Pr. सम्रापद, (H. C. 2, 101 has सम्रापद,). H. सराप्ते.
- 332 चन pierce = Skr. बन्न or चन्न, I. cl. बन्नित or चन्नित, Pr. चन्नद, H चन्नी.
- 833 संबार् or सवार् or समार् prepare = Skr. सम्ह, Causal संबारयित, Pr. संबारेइ or VI. cl. संबारइ, H. संबारे, &c.
- 334 चर् ondure = Skr. चर्, I. cl. चरते, Pr. चर्र (H. C. 1, 6), H. चर्.
- 335 सदर् arrange = Skr. सम् + द्व, I. cl. संदर्शत, Pr. संदर् (H. C. 4, 259 = Skr. संदर्शति, in H. C. 4, 82 also सादर्), E. H. सदरे.
- 896 साम् settle = Skr. साम्, Causal सामयति, Pr. साभेद्र (cf. Spt. 188 सादेद्र) or VI. cl. सामद्र (cf. Spt. 260 साद्द्र), H. सामे. The form साम् does not occur in Hindí.
- 837 सार् accomplish = Skr. स, Causal सारवित, Pr. सारेद or VI. cl. सारद H. सारे.*
- 838 सास pierce = Skr. म, Causal भारयति, Pr. सारेड् or VI. cl. सार्ड्; H. सार्थे. Or from Causal of क्ल, see No. 332.
- 839 साँस threaten, distress = Skr. बंग, Causal समयित, Pr. संगेद्द or VI. cl. संस् (H. C. 4, 197 where however it is = बंगते), H. साँसे.
- 340 सी sew = Skr. सिन्, IV. cl. सीमति, Pr. VI. cl. सिन्द् or सिम्द्, H. सीर. H. C. 4, 230 gives सिम्बद् which would be सीने in H., but it does not exist; there is, however, another reading सिम्द्, H. सीने which does exist, see No. 342.
- 841 ਚੀਵ learn Skr. ਕਿਵ, I. cl. ਕਿਵਨੇ, Pr. ਚਿਚਰਵ (cf. Spt. 353), H ਚੀਵੇ. 842 ਚੀਵ or ਚੀਵ or ਵੀਵ irrigate - Skr. ਚਿਵ, VI. cl. ਚਿਵਨਿ. Pr. ਚਿਵਨ
- The root means also "palish" (by rubbing, striking); perhaps this is the writer mentioned by H. C. 4, 84 as equivalent to the Skr. Nation,

- (H. C. 4, 239) or বিষয় (H. C. 4, 230), H. বীৰী or বৌৰী or (corr.) বৌৰী (cf. Vr. 2, 41 হল• = বস•, Ls. 199.)
- 843 सीज exude, sweat = Skr. बिद्, IV. cl. बियति, Pr. सिव्यद् (H. C. 4, 224), H. सीजे. See also No. 344.
- 844 सीज् seethe, boil, exude, sweat = Skr. बी (or बा), Passive बीबते, Pr. सिकार, H. सीजे.
- 345 सीख be received (as money) be liquidated (as debt) = Skr. बि, Passive त्रीयते, Pr. सिळाइ, H. सीखे.
- 846 सुधार् adorn = Skr. सु-भू, Causal सुधारयति, Pr. सुधारेह or VI. cl. सुधारह, H. सुधारे.
- 347 शुन् hear = Skr. मु, V. cl. प्रशेति, Pr. VI. cl. सुब्द (Vr. 8, 56), H. सनै.
- 348 समर् remember = Skr. कृ, I. el सारति, Pr. समरद् (Vr. 8, 18), H. समरे.
- 849 सुदाव be agreeable = Skr. सुद्ध, X. cl. सुदावित Pr. सुदाविद (Spt. 169) or VI. cl. सुदावद, H. सुदावि.
- 850 हैंब् smell at = Skr. सम्बा-न्ना, I. cl. समाजिन्नति or II. cl. समान्नाति, Pr. समबेद or VI. cl. समान्द्र, H. हाँगे.*
- 851 चूंज swell = Skr. वि, Passive ग्रूबते, Pr. युजार, H. खजी.
- 852 सम्म appear = Skr. ग्राम्, IV. cl ग्रामित, Pr. ग्राम्भर, (cf. H. C. 4, 217), H. समी.
- 853 चेंद् irrigate = Skr. सांद्, Causal सान्दयति, Pr. विदेश or VI. cl. विदेश, H. विदेश of No. 326.
- 854 सेव् or सेव् serve, worship = Skr. सेव्, I. cl. सेवते, Pr. सेवर् (H. C. 4, 896), H. सेवे or सेवे (with euphonic प्, see my Comp. Gramm. § 69).
- 855 साच् regret, meditate = Skr. श्रच, Passive श्रचते (used actively) Pr. सुचर, H. सेर्चे.
- 856 से प्र shine, be fit = Skr. ग्राम्, I. cl. ग्रोमते, Pr. से प्र (H. C. 1, 187), H. सार्थ.
- 857 चींप् deliver == Skr. चम्-फ, Causal चमपेयित, Pr. चमप्पेर् or VI. cl. चमप्प्र, H. चोंपे. See No. 349, footnote.
- 358 इन् kill = Skr. इन्, II. cl. इन्ति, but Vedic also I. cl. इन्ति, Pr. इच्डू. (H. C. 4, 418), H. इने.
- 859 चर् take away = Skr. च, I. cl. चर्रन, Pr. चरइ (H. C. 4, 234), H. चरे.
- जा would form जोइ or जाइ in Pr., just as इर or इर of स्था; and सम would contract to से in Hindi, just as in संभि for Pr. समस्य, see No. 357; the intermediate form being समज्ञाह (cf. H. C. 4, 397). The root, however, might be derived from Skr. जिंच, I. cl. सिंगति, Pr. सिंगह; only the Hindi ought to be सीचे; and the change of है to ज would be very anomalous. (Dr. B. Mitra in his vocabulary quotes चे अभाषाहाल?).

- 360 परिस् or प्रस् be glad = Skr. पुष्, I. cl. प्रवेति, Pr. परिसर् (Vr. 8, 11; perhaps denom. of परिस् = प्रवे Vr. 3, 62), E. H. परिसे or W. H. प्रसे. See No. 209.
- 361 रहाप् tous about Skr. इस्, (Causal Passive इसायते), Pr. रहापर, H. रहापे.
- 362 चना seream = Skr. हे, I. cl. इचित, Pr. VI. cl. चनाचह or (contr.) चनाह, H. चनाच्.
- 363 चंस or चांस् laugh = Skr. चुस, I cl. चसति, Pr. चसद (T. V. 2, 4. 69) or चसुद (Passive), H. चर्से or च से.
- 864 चाँप or चाँच blow = Skr. भा, Causal भाषयति, Pr. धंपेइ or VI cl. धंपइ or चंपइ, H. चाँपे or (corr.) चाँपे.
- 865 খাৰ intr. shake Skr. কৰ, Passive কথান (used actively), Pr. খবং, H খাৰ. See No. 68.
- 866 दिख intr. shake Skr. मृ, I. cl. अरति, Pr. VI. cl. दिरद् or दिखद्, H. दिखे.
- 367 डब् sacrifice = Skr. घू, V. cl. घुनोति, Pr. VI. cl. घुनर् or डब्र् (H. C. 4, 241 where it is referred to Skr. root ड), H. डने.
- 868 इस् drive, good = Skr. इस् go, Causal इस्यात, Pr. इस्टेर् or VI. cl. इस्ट्र, H. इस्.
- 369 के be = Skr. भू, I. cl. भवति, Pr. भवद् or क्वद् or काद (H. C. 4, 60), H. काय

PART II .- Secondary Roots.

Comp. = compound root; den. = denominative; der. = derivative; N. = noun; P. P. = past participle passive.

The Sanskrit equivalents are not given, unless when they actually exist; what theoretically they might have been, has been explained in the introductory remarks; see also my Comparative Grammar, §§ 351—354.

Some of the explanations attempted in this list, are, of course, only tentative; a few such have been indicated by a mark of interrogation.

- 1 comp. was be hindered, stopped = Skr. ws + a, Pr. wsat or weat. H. was.
- 2 comp. जनक be raised, rise = Skr. जन + 5, Pr. जनकेंद्र or जनकर, H. जनके.
- 8 comp. जबक् vomit = Skr. जक्-वम् + छ, Pr. जमकेर् or जमकर, H. जबके.
- 4 comp. फाक् or चौंक vomit = Skr. बस + क, Pr. बसकोर or बसकार,
 Ap. Pr. बसेक्स, H. चौंके or फाके (with चा for चार्व or चास, see my
 Comp. Gramm. § 122).

- 5 der. sag be pulled out, slip out, a passive or intransitive, derived from sag, see No. 6.
- 6 den. বৰাৰ or বৰৰ pull out, uproot = Skr. P. P. বৰাৰ, Pr. বৰাৰ (cf. H. C. 4, 187), H. বৰাৰ (for বৰাৰ, with transferred aspiration, see my Comp. Gramm. § 132) or বৰ্ণৰ (for বৰ্ণৰ with change of a to e, see my Comp. Gramm. § 148). See No. 13.
- 7 den. बाढ़ put on, dress = Skr. जपबेष्ट, I. cl. जपबेष्टते, Pr. बावेचुर. (cf. H. C. 4, 221), H. बाढ़े (contracting बाबे to बा). Probably from a P. P. P. of the root विज्ञ.
- 8 comp. बहुब् crackle, thunder = Skr. बहें + ज, Pr. बहुबेर or बहुबर, H. बहुबे.
- 9 den. कसाव earn = Skr. N. कर्म; Pr. कसावेद or कसावद, (H. C. 4, 111 has कसावद and gives it as a substitute of the root उपमुख; the á is shortened to a, by H. C. 8, 150), H. कसावे.
- 10 comp. कसक् be painful, be pained = Skr. कप + छ, Pr. कसकोर or कसकार, H. कसकी.
- 11 der. बार be cut, a passive or intransitive, derived from root बार, see primary roots, No. 27.
- 12 der. ক্ত be pulled out, escape, a passive or intransitive, derived from root কাতু. See No. 13.
- 13 den. काड़ pull out = Skr. P. P. P. कह; Pr. कहर (H. C. 4, 187), H. काड़े.
- 14 comp. The or the make a tremulous noise, rustle, rattle = Skr. There is also a reduplicated root act or the same meaning. They also occur in Maráthí and Panjábí. The primary meaning of the root is; slip or glide along with a sound; this is preserved in the Maráthí act or the which is used of the running of a stream, or the crashing of a boat, dragged over gravel, &c. The simple root at occurs in Maráthí with its original meaning be shed, fall off; also in Panjábí, where however it has become transitive, carry off. The change of a or to to or is anomalous; but it already took place in Prákrit; thus in Spt. 44, and the transitive, connection with the root at compare also the roots at and att. See also roots at and atta.
- 15 der. जब् be hollowed, be sunk, a passive or intransitive, derived from root जाव ; see No. 16.
- 16 den. बाइ hollow, bury = Skr. N. बते, Pr. बहु (Vr. 3, 25), Pr. बहुर or बहुर, H. बाई. Or possibly a mere corruption of root बाइ, No. 17, by disaspiration.

- 17 den. बाह्र dig in, fix in, bury = Skr. P. P. नाड (of root बाह्र), Pr. बाहर, H. बाहर.
- 18 den. बाद mark, brand = Skr. N. बाद ; Pr. बोद्द or बोद्द, H. बोद (?); brands being made on the forehead or bosom.
- 19 den. स्वराव be alarmed, agitated, perhaps corrupted form अव्यवस्था with the same meaning, a reduplicative or alliterative form, made from अव = Skr. N. अव noise, cries of alarm (?).
- 20 den. विवाब or विविधाय be disgusted = Skr. N. प्रका or deminutive प्रक्रिका (of root प्रक्), Pr. विका (H. C. 1, 128) or विविधा ; Pr. विकाब or विविधाय or विविधाय or विविधाय . H. विवाब or विविधाय .
- 21 der. चिर् be collected, surrounded, gather, a passive or intransitive of root चेर्. See primary roots, No. 64.
- 22 comp. चपक be compressed, collapse = Skr. चप or चप + छ, Pr. चपकेर or चपकर, H. चपके.
- 23 comp. चमक् glitter = Skr. चमत् + छ, pass. चमत्त्रियते (with active meaning), Pr. चमकेंद्र or चमक्द, H. चमकें.
- 24 den. Wish, corrupted for WIN, see No. 40.
- 25 der. (see No. 31. a passive or intransitive, derived from root
- 26 den. चित्रनाव smooth, polish = Skr. N. चित्रच (or चित्रिच; perhaps itself a compound word of चित्र bright = चित्र, and क = Pr. किए; lit. made clear); Pr. चित्रचावेद or चित्रचावद, H. चित्रनावे.
- 27 den. चिडाब or चिडाब abuse, vex = Skr. P. P. P. चित्र (from root चिष् abuse); Pr. चिडाबर, H. चिडाब (with transfer of aspiration) or चिडाब (with loss of aspiration). As to the changes of aspiration, see No. 47 चेड or चोड, where it is preserved; also primary root, No. 65 चड (footnote, p. 45). As to the change of त्र to च to च (or च), compare root जड़ाब from P. P. P. चुन्न; and primary roots Nos. 92, 93 चड and चोड़.
- 28 den. चितान make known to, warn, admonish = Skr. P. P. चित्ता; Pr. चिताने or चितानर (cf. S. B. 11, 1), H. चिताने. In Setubandha 11, 1 occurs the past participle चित्तानचं (with a for á, by H. C. 3, 150), which is correctly explained by the commentator as meaning चित्तनं made known to, or निवानं restrained, warned (or निवानं), परितापनं admonished, comforted; (see S. Gdt. pp. 84, 156).
- 29 den. चीत paint = Skr. N. चिन; Skr. चिनयति, Pr. चिनेद् or चिनद, H. चीते.
- 30 den. चीन् or चीक् recognize = Skr. N. चिक्क, Pr. चिक्क (H. C. 2, 50); Skr. चिक्क्षति, Pr. चिक्क्रे or चीने.
- 31 den. चीर् tear, cleare = Skr. N. चीर (rag), whence Skr. चीरवति, Pr. चीरेंद्र or चीरद, H. चीरें.

- 32 comp. जुन be finished, oease = Skr. जुन + क; Pr. जुन (H. C. 4, 177), H. जुन. H. C. gives it as a substitute of the Skr. root जुन fall down, decay, a synonym of जुन; so also the commentator to Spt. 323, see Wb. p. 184. The correct derivation from जुन is given by the commentator on Setubandha 1, 9. The Skr. root जुन inflict pain, X. cl. जुन्दान, is doubtlessly reintroduced from the Prákrit. See No. 33.
- 33 comp. चूच blunder, miss = Skr. चून + च; Pr. चूचर, H. चूजे. This is clearly identical with the former, as regards origin. The original meaning "fall," "drop," (from the truth) would easily lead to "blunder." In this sense it is well-known to Prákrit; e. g., Spt. v, 323, चूचरंकचा "blundered or missed meeting"; again Spt. v. 199, Setubandha 1, 9, where the commentary correctly explains it प्रवाद देशों द्वित केचित, i. e., according to some it is a desí word meaning "blundering" (See S. Gdt., p. 157). See No. 32.
- 84 den. चोराव steal = 8kr. N. चार or चौर; Pr. चोरावेद or चोरावर, H. चोरावे.
- 85 comp. चौंक् start (from fright) = Skr. चमत्+ क, passive चमत्तिवते (used actively), Pr. चमकेद or चमकेद, Ap. Pr. चमकेद, H. चौके.
- 86 der. जन be strained, filter, a passive or intransitive derived from ज्ञान, No. 38.
- 87 den. वस् deceive, cheat = Skr. N. इस; Skr. वसवित, Pr. वसेर् or वसर, H. वसे.
- 88 den. चान् strain, search = Skr. P. P. स.च (of root संद्), Pr. असीर् or चत्रेर (Ls. 199) or चत्रर, H. चाने (?).
- 89 den. True stamp, print; an active or transitive derived from root True; perhaps merely another form of root True; see Appendix Nos. 4 and 13.
- 40 den. बाचू or बाचू wish = Skr. N. ब्याचू Pr. ब्याच्द (cf. H. C. 2, 22) or ब्याच्द, H बाच्च or (disaspirated) बाच्च ; or from Skr. N. द्वा, Pr. द्वाप्द or द्याच्द, H. बाच्च (with transferred aspiration) or बाच्च. As to the elision of initial sor द, see my Comp. Gramm. § 173 (cf. Addenda); and as to the change of aspiration, ibidem § 132.
- 41 comp. विटक् be dispersed, be scattered = Skr. विश्व + छ; Pr. विडकेइ or विडकेइ, H. विटके. See No. 46.
- 42 den. चिड् be vexed, take offence, a passive or intransitive, derived from R. चीड् or चेड्, No. 46.
- 48 comp. विकृत sprinkle = Skr. खुष्ट + स; Pr. विकाद or विकाद, H. विकृत. As to the derivation of विकृति from Skr. खुष, see No. 45 की इ; and as to the softening of the final, की ड is to विकृ, as खुद to को इ, q. v.

- 44 den. बीच् enceze = Skr. N. विद्या; Skr. विद्यवनि, Pr. विदेश or विद्या,
 H. बीचे. The word विद्या, however, is itself a compound from वित्
 encezing and स; and the word वित् is probably another form of
 चत्र encezing, from Skr. root चु enceze.
- 45 den. बीड or बीड or बेड sprinkle = Skr. P. P. खुद sprinkled,
 Pr. खुद (with कि for खु, as in किस्त or क्यार or क्यार, H. C. 4, 182.
 257; see also primary roots Nos. 78, 80); Pr. बिहेद or बिहर,
 H. बीड or बीड or बेड (on disaspiration see my Comp. Gramm.
 § 145, Exc. 2; on the anunásika, § 149; and on the change of
 द to द, § 148). Or from Skr. N. बेख (of root विच्), see primary root
 No. 342.
- 46 den. बीक् or केंद्र abuse, vex = Skr. P. P. P. किस abused; Pr. केंद्र or केंद्र, H. केंद्र or कोंद्र. See Nos. 27, 42. Probably from किस was derived a root किंद्र, just as Skr. root कंद्र from चन्न; the causal of किंद्र would be केंद्र, just as causal केंद्रि of कंद्र; whence we should have Pr. केंद्र, just as Pr. कोंद्र, and H. केंद्र just as H. कोंद्र. The root किंद्र which would correspond to कंद्र does not exist in Hindí, except in the compound किंद्रक, see No. 41. A similar series of roots are क्ट्र or क्ट्र and केंद्र. Possibly also Nos. 48 and 45, may be derived from कि.
- 47 den. बीब take away, snatch = Skr. P. P. विश्व (of root विद्), Pr. विश्वेद or विश्वद, H. बीबे.
- 48 den. we or we be let off, be released = Skr. P. P. P. Two, Pr. www. (H. C. 2, 138) or we (S. C. 1, 8, 142 we?); Pr. west or wet, H. we or we. See Nos. 46 and 50. The root we or we has not been adopted into Sanskrit, except in its causal or transitive form
 - * There would be the following series of forms:
- Skr. बह, Pr. बहा or जह; Roots Skr. बह, Pr. जह or बह, H. बह or बह, Caus. बहु " बह, " बह, " बहु, " बह
- † The root we does exist in Skr., but it has assumed a somewhat different, though connected meaning "cut" (whence H. well knife). The same transition of

- 49 den. चेद् perforate = Skr. N. चिद्र (of R. चिद्र); whence Skr. चिद्रचित, Pr. चिद्दे or चिद्द, H. देदे.
- 50 der. काड् release, an active or transitive, derived from R. चुड No. 48. Compare Skr. root चोड.
- 51 den. ज्ञाव pair off labor (i. e., assist another with labor, in expectation of similar assistance being returned hereafter) — Skr. N. युमा, Pr. ज्ञाब (H. C. 2, 78); Pr. ज्ञाबेर or ज्ञाबर, H. ज्ञाबे. The root comes to mean generally: be provident, be careful of.
- 52 den. खताव make known, warn = Skr. P. P. भूत्र (of caus. of R. जा); Pr. जातावेद or जातावद, H. जातावे.
- 58 den. जम् germinate = Skr. N. जम, Pr. जमोद्द or जमाद् (H. C. 4, 136), H. जमे
- 54 den. जीत् overpower, win = Skr. P. P. जीत (of R. ज्या); Pr. जित्ते or जित्तर्, H. जीते.
- 55 der. ज ह be joined, a passive or intransitive, derived from root बाइ see No. 57.
- 56 den. जुट् unite = Skr. P. P. युम्न, Pr. जुम (H. C. 1, 42) or जुड़, (see Nos. 46, 48), Pr. जुड़ेर or जुड़र, H. जुड़े. Compare Skr. root जुड़.
- 57 der. जाड़ join, an active or transitive, derived from root जुड, see No. 56.
- 58 den. जोत् yoke = Skr. N. योज्ञ, Skr. योज्ञयित, Pr. जोत्तेर or जोत्तर, H. जोते.
- 59 den. जोष् or जोष् or जो see = Skr. N. जोतिस् eye, sight; Pr. जोर्द् (H. C. 4, 422, 6) or जोष्ट् (cf. H. C. 4, 332 जोषंतिषे), H. जोरे or जोवे or जोदे (with euphonic व् and प्, see my Comp. Gramm. § 69).
- 60 comp. भटक tr. twitch, intr. shake = Skr. भट + हा; Pr. भाइकोर or भारकार, H. भारको. As to the derivation of भार, see primary root भार No. 96.
- 61 comp. अस्पन् intr. spring; tr. throw on, move to and fro, snatch = Skr. आप + हा; Pr. अपन्ने or अपन्न, H. अपन्ने. Hemachandra 4, 161 notices the corresponding uncompounded verb आपन्, but only as an intransitive "move to and fro" (said to be = Skr. अमित). Hindí and Maráthí have the same uncompounded verb आप, but as a transitive, "cover with a thatch" (lit., throw on, i. e., bundles of

meaning may be observed in another series of Skr. roots, which also are derived from The latter becomes in Pr. 187 (H. C. 2, 127) or 17 (Spt. v. 278) or 15; whence Pr. den. roots 15 or 15 (H. C. 4, 116 125 and 155 he breaks), H. 15 deg does not exist). This root 15 as well as the corresponding causal or transitive forms 15 or 15 have been adopted into Sanskrit. See primary root No. 41.

- grass.)* As to the derivation of win, see Appendix No. 6. Hindí has an adverb win quickly; it has also another kind of compound root wing with the same meaning as wing. On these obscure compound in a roots, see my Comp. Gramm. § 354, 2.
- 62 comp. सहस् shine, glare = Skr. भारा + क; Pr. भारतीर or भारतार, H. भारती. As to the derivation of भार, see primary root No. 98.
- 63 den. आंक् peep, spy = Skr. N. अधा ; Pr. अवभक्त्, H. आंके (with loss of initial अ, and disaspiration)?
- 64 comp. भी क् sigh, lament = Skr. जीत् + क; Passive जीतनीयते (used actively), Pr. शिक्षेद्र or शिक्षद् . H. भी के.
- 65 comp. भुक् or भोक् stagger, nod, bend = Skr. चुभ (acc. sg. neut. चुप)+ क; Pr. भक्द, H. भक्दे or भोके.
- 66 comp. क्षोक or क्षोंक throw, cast = Skr. चेप (or चप) + कः Pr. क्षेत्रकार, H. क्षोंक or क्षोक्ते. As to को = एव, see my Comp. Gramm. § 122 ?
- 67 der. Tem be propped, stay, a passive or intransitive, derived from No. 68.
- 68 comp. डेक् *prop*, support = Skr. नाय (of root नै) + क; Pr. टायसर, H. टेके?
- 69 den. 35 fix, arrange = Skr. P. P. P. 44 (of root क्य); Pr. 35 or 35 th. 33. The hardening of a to a is probably caused by the influence of the initial a. In old Hindí 35 occurs in the sense of "stopping short", "standing amazed". When the past participle is used as such (not as an element of a denominative verb), the original a is still preserved in Hindí; thus old Hindí 316, modern Hindí 331 "standing".
- 70 comp. उठक् or उठक् stop short, stand amazed = Skr. स्था + क; Pr. उद्देश, H. उठके or उठके. As to the derivation of उठ, see No. 69; as to द for द, see my Comp. Gramm § 35.
- 71 comp. उनक jingle, tinkle, &c. = Skr. सन sounding + क; Pr. उनकेर or उनकर, H. उनके. Compare Skr. उंकार clang, twang, &c. from र + क; उ or उ means any "sound."
- 72 comp. उसक् strut = Skr. साथ + स ; Pr. उसक्द or उच्चाद, H. उसके.
 Skr. साथ becomes Pr. शंभ or उभ (H. C. 2, 9, whence H. शाम prop, pillar and उाम् place, residence. The change of भा to च to म may be observed in the primary roots Nos. 117, 118.
- 78 comp. তথ্য knock, chip = Skr. নৰ + ছ, see root তাঁৰ No. 10. in Appendix. Hindí has an interjection তথ, imitating the sound of knocking or hammering; also তথনী rammer (an instrument).
- 74 den. 344 be fixed, remain, another form of No. 75; possibly arisen by
- Panjábí has সাঁৰ, with ৰ্ for प; and সাঁজ thatch, with ৰ্ for प. The former might be referred to the Skr. root মাৰ্.

- a mere transposition, so therh = say tharch = say thahar = say thahar. Or the element way be the same as wor we in say or say, &c. (see my Comp. Gramm. § 354, 2), and say = Pr. say = Skr. way. Hindí has the noun say place.
- 75 den. डाड़ or डाड़ be fixed, be erect, stand = Skr. P. P. खुक्स, Pr. डड़ (H. C. 2, 39); Pr. डड्ड (or डड्ड, H. डाड़ or डाइ.
- 76 den. στ fear = Skr. N. στ, Pr. στ (H. C. 8, 217); Pr. σττ (H. C. 4, 198), H. στ.
- 77 den. sit be hot, burn = Skr. N. sit, Pr. sit (H. C. 1, 217);
 Pr. sitt or sitt, H. sit.
- 78 comp. **Eq.** cover = Skr. N. **证** (acc. sing. neut. **证** covering) + 语; Pr. **Eq.** (H. C. 4, 21), H. **Eq.** See primary root No. 105.*
- 79 der. डस् or डर् flow, a passive or intransitive of root डास् or डार्, see Appendix No. 11.
- 80 comp. यह or यह be wearied, be fatigued = Skr. यह (acc. sing. neut. यह) + क; Pr. यहें (H. C. 4, 370) or VI. cl. यहर (H. C. 4, 87. 259; where it is said to be a substitute of Skr. पहान move slowly from fatigue), H. यह or यह . In H. C. 4, 16 the root is given as an equivalent of खा stand; the Bangálí has यह (pronounced thak) stay, remain. The original meaning of the Hindí is to come to a stop (from fatigue). The Skr. passive खारते (= यह + कीयते) means "to be made firm or rigid, be paralysed, be stopped. The original meaning of "rigidity" is preserved in the Hindí यह or यह a congealed lump, a clot. The stoppage may be owing to fatigue or to wonder; hence Hindí यहिन stopped or wearied or astonished. Other derivatives of the Hindí root are व्यव unwearied, वहावन् weariness, बहाफका perplexed.†
- 81 comp. चपक strike, slap, tap from चप + स; as to the derivation of चप, see root चाप in the Appendix No. 13.
- It might be also derived, as a primary root, from Skr. নত্, I. cl. নতার, Pr. নতার = ভার (with transfer of aspiration) = ভার (softening and cerebralising ছা). Compare the roots তাঁঘ, তক্, তাঘ্. তাক্ in the Appendix, which show that the Skr. roots নত্ and কছা had a tendency in Prákrit to transfer the aspiration (ছা) and cerebralise the initial (ত). The Skr. root নত্ means chipping of (by striking) and covering; a similar change of meaning appears in the Hindí root নত্ cover from Skr. তা্ ব্যাদে, strike.
- + S. Goldschmidt, Prákritics, No. 7, p. 5 derives it, as a denominative root, from P. P. P. ATA of a root and, which he identifies with the root and assumes a change of TA to T. This theory is based on three hypothetical steps: the identity of and and and, the existence of a P. P. P. ATA, the change of TA to T. Pischel in Beszenberger's Beiträge III, 235 derives it simply from a hypothetical Skr. root and.

- 82 comp. चल्च or चर्च tremble, flutter; probably a mere various pronunciation of चर्च or चर्च, q. v.; the interchange of wand wis shown by the Pr. पहार and चल्चर (H. C. 4, 87), and that of wand with (H. C. 2, 8). There is also a reduplicated root चल्चच or चर्चर corresponding to चर्चर and चर्चर.
- 83 comp. चिरक be set, be settled, well postured (e. g., in dancing) = Skr. श्चिर + स्न ; Pr. चिरकेर or चिरकर, H. चिरके.
- 84 den. विराव् intr. settle (as liquor) = Skr. N. स्थिर; Skr. स्थिरायति Pr. विरावेद or विरावद, H. विरावे.
- 85 comp. बुक spit = Skr. हेब (or स्थेव) + स; Pr. श्रेकेर or श्रुक्तर, H. बुके. As to the contraction of रव to च or च, see my Comp. Gramm. § 122.
- 86 den. इच्छू or देव्ह run = Skr. N. इव, Pr. diminutive इवड; Pr. इवडेट् or इवडर, E. H. इवडेट् or W. H. देवि. In Chanda's Prákrit Lakshana C D, II, 27%, there is noticed a root इवडव run about with lowering face (ছবিশেষাই অইম্বান হ্বার্থান ব্যৱহা); Maráthí has both इवडव and इवड in the same sense; it has also इवड run; these two roots are probably identical, the change of initial द to we being not uncommon; see H. C. 1, 217.
- 87 comp. ब्रह्म intr. split = Skr. दर + छ ; Pr. ब्रह्मेर or दः सर्, H. दरके.
- 88 comp. इंडब् intr. burn = Skr. इंड + कः Pr. इंडबंद or इंडबंद, H. इंडबंदे.
- 89 den. दुव intr. pain = Skr. N. दुःव ; Skr. दुःववति, Pr. दुव्येद् or दुव्यद्, H. दुवे.
- 90 comp. use blaze, be hot (from any passion), be distressed, tremble (from fear), = Skr. दा + स, Pr. द्वार, H. धवते (for द्वते, with transfer of aspiration). There is also reduplicated root useus.
- 91 den. बार् pour = Skr. N. बार; Pr. बारेंद्र or बारद, H. बारे.
- 92 comp. बींक or बाक blow, breathe spon = Skr. धम + क; Pr. धमकेर or Ap. Pr. धर्मकर, H. धींक.
- 93 den. जड dance = Skr. N. जते; Skr. जतेवित, Pr. जहेर or VI. cl. जहर (H. C. 4, 230. 2, 30), H. जडे. The Skr. root जड (I. cl. जडित or X. cl. जाडबित) is adopted from the Prákrit.
- 94 der. ৰঙ্ flow, a passive or intransitive, derived from primary root ৰঙ্গ No. 136.
- 95 den. नपाड flee = Skr. P. P. मुख (of R. सुन् eject); Pr. प्यस्त, E. H. नपाडे. Compare Pr. प्राप्त (H. C. 4, 200) from Skr. प्राप्त.
- Hindí has a word we body, and we firm, strong, sound. This is probably derived from Skr. we Pr. we H. we.

- 96 der. निकस or निकार be pulled out, come out; a passive or intransitive, derived from root निकास. See No. 98.
- 97 der. विकस. be expelled, come out; a passive or intransitive, derived from root विकास. See primary root No. 139.
- 98 den. निकास or निकार pull out, eject = Skr. P. P. निकास ; Páli and Pr. निकास, Pr. निकास or निकास , W. H. निकास or E. H. निकार. As to the change of ड to स्ह, see my Comp. Gramm. § 115.*
- 99 den. निसेष्ट्र or निसेष्ट्र peel, extract = Skr. P. P. निस्कृष्ट; Pr. निस्कृष्ट् (with o for u, by H. C. 1, 116) or निस्कृष्ट् (with transfer of aspiration, as in स्वस्थाहर H. C. 4, 188 = स्क्रोप्ट्र, a denominative of साकृष्ट extracted).
- 100 den निकास grin = Skr. N. निकुसाय (from root नि + क + स्मि); Skr. निकुसायते, Pr. निकासोद or VI. cl. निकासाद (cf. H. C. 1, 116), H. निकास. See my Comp. Gramm. § 148.
- 101 den. निगल swallow = Skr. N. निगल; Pr. निगलेइ or VI. cl. निगल . H. निगले. It might, however, be a primitive root = Skr. नि + उट, VI. cl. निगलति, with change of इ to च.
- 102 den. निषद् terminate = Skr. N. निष्पत्ति (from root निष्+पद्); Pr. निष्पद्दे or VI. cl. निष्पद्द, H. निष्टे (?). As to the change of dental न to cerebral इ. compare Pr पद्दुषं for Skr. प्तनं, Vr. 3, 23; cf. also Pr. पहर् for Skr. प्तति Vr. 8, 51.
- 103 der. निवस् or निभ् be accomplished, succeed, a passive or intransitive root, derived from the primary root निवास, No. 146.
- 104 den. पहर or पैट enter = Skr. P. P. प्रविष्ट, Pr. परइ (H. C. 4, 340); Pr. परइंट or VI. el. परइंट, E. H. पर्ट or W. H. पैट.
- 105 den. पक् ripen = Skr. P. P. P. पक, Pr. पक्क (H. C. 2, 79); Pr. पक्केट्र or पक्क. H. पक.
- 106 den. प्रकृ seize = Skr. P. P. P प्रकृष् (cf. H. C. 4, 187), H. प्रकृष (for प्रकृष, with lost aspiration, as in root माडू No. 16, प्रकृष No. 6, टाइ No. 75, and others).
- 107 den. पञ्जाब repent = Skr. N. पञ्चाचाप; Pr. पञ्चनावेद् or VI. cl. पञ्चनावद, H. पञ्जावे.
- 108 den. पड be paid, be roofed, be watered Skr. N. पच or पड or पड; Pr. पहेर or VI. cl. पहर, H. पडे. Skr. पच is any "vessel", used for irrigating; पह is the table or leaf on which the accounts of payments are kept; पड means a "roof."
- * So also Bs. I, 354. III, 58. The Hindí root निकास is, of course, referable to the Skr. root निस् + कस्; but the latter is most probably itself adopted from the Prákrit; Skr. निकासर्थात = Pr. निकासर्थ. The Pr. form निकासर्थ, quoted by Bs. III, 58, is misspelt for निकासर्थ.

- 109 den. प्रवास expand, grow, prosper Skr. N. प्रपन्न (of root प्र-पंज्), Skr. प्रपन्नकि, Pr. प्रवास or प्रपन्न (cf. Pr. प्रवास = Skr. पंजासत H. C. 2, 42), H. प्रवास (transposed from प्राप्त, see my Comp. Gramm. § 133, see also primary roots Nos. 165, 166).
- 110 den. पविकाद irrigate = Skr. N. पाकीय, Pr. पादिच (H. C. 1, 101), Pr. पादिचादे or पादियादर, H. पविवादे (see my Comp. Gramm. § 25).
- 111 den. परिस् or प्रस् touch = Skr. N. सामें, Pr. परिस (Vr. 3, 62); Pr. फरिसद् (H. C. 4, 182), H. परिसे or प्रसे (with lost aspiration, and change of i to a; see my Comp. Gramm. §§ 58 note, 180).
- 112 den. पखद or पख्य intr. turn over = Skr. P. P. P. प्रथम, Pr. पखड or पखल (Vr. 3, 21. H. C. 2, 47), Pr. पखडर or पखलर (H. C. 4, 200), H. पखडे or पखरी. In H. C. 4, 200. 258 पण्डल and पण्डल are spelled so; see my Comp. Gramm. § 161.
- 113 den. परिचान or परचान recognise = Skr. N. परिचयन; Pr. परिचयचेड् or परिचयचेड्, H. परिचान or परचान (for परचान ; with elided र् and inserted euphonic च, see my Comp. Gramm. §§ 69, 124) (?).
- 111 der. पित्रन or परिन intr. dress, put on, a passive or intransitive, derived from the primary root पिर्नाव or परिनाव, No. 165.* See also primary root परिद No. 166.
- 115 comp. पिषक be squeezed, be shrivelled Skr. पिष + छ; Pr. पिषके or पिषके, H. पिषके Compare Skr. पिषक squeezed; and as regards the derivation of पिष or पिष, see primary root पीष No. 175. The word has been adopted into Skr. from the Prákrit. †
- 116 den. पिक्स or पिक्स slip = Skr. N. पिक्स or पिक्स slippery;
 Pr. पिक्सेर or पिक्सर, H. पिक्स or पिक्स (transferring the aspiration to प and changing स to ए; see my Comp. Grammar § 11). See No. 125.
- 117 der. पिड be beaten, a passive or intransitive, derived from root पीड No. 119.
- 118 der. पिड् be beaten, bruised, a passive or intransitive, derived from root पेड, No. 121. See also No. I, 184.
- 119 den. पोड beat = Skr. P. P. पिट: Pr. पिटेंद्र (Spt. 173) or पिटंद्र (with ह for ह, as in पण्डद्र for पण्डद्र (H. C. 4, 200), H. पोडे. See No. 121.
- 120 den. पुकार call, shout = Skr. N. स्कूत्कार or पूत्कार or पूत्कार; Pr. सुद्धारेड
- In Bengálí the root is पिन्स, which is a denominative of the Skr. P. P. P. 1944 dressed. Possibly the Hindí root may be explained in the same way by a further change of w to w.
- † In the Skr. word चिविट pressed down a metathesis of **q** and **q** appears to have taken place.

- or पुद्धारेद or पुद्धारेद, H. पुद्धारे. A similar change of प to प, in root परिष् No. 111. An intransitive or passive form of this root occurs in the old Hindi of Chand's Prithiráj Rasau: पुद्धर् be called.
- 121 den. पेस् squeeze, beat = Skr. P. P. P. पिष्ट ; see primary root No. 184.
- 122 den. ve revile, perhaps = Skr. N. ve blessed; euphuistically.
- 123 comp. प्रदेश tr. separate, winnow, or intr. be separated = Skr. स्वड + सः; Pr. प्रश्नेद or प्रश्नेद, H. प्रदेश. The Pr. doubles the radical दः; see primary root पर No. 186.
- 124 comp. परक् or पड़क् tremble = Skr. स्कर् + क; Pr. परकेर or परकर, H. परके or पड़के. The reduplicated root परकर् or पुरफुर् also occurs. See roots चरक No. 82 and चरक No. 14.
- 125 den. বিষয় slip, slide, see No. 116. For a similar transfer of aspiration on account of change of ছ to ড, see root ত'ড় in Appendix No. 8.
- 126 comp. फूँक् blow = Skr. फूत् + ज ; Pr. फक्केंद् or फ्राइ, H. फूँके. See H. C. 4, 422, 3. फ्राइक्कंत, and Spt. 178 फ्राइत च.
- 127 der. पुत्र be blown, a passive or intransitive, derived from root पूज् No. 126.
- 129 comp. बक् talk, chatter Skr. बाच + क; Pr. बक्द, H. बक. Or possibly a mere corruption for बुक्, Pr. बुक्द or बुक्द (H. C. 4, 98), Skr. बुक्कित or बुक्क्यित a comp. of हू + क. Hindí does not possess the form बुक्, but it has a derivative of it, बुक्कियां ; Maráthí has both बुक् and बुक्क.
- 130 den. व च read, recite = Skr. N. वाच ; Pr. ववर, H. वांचे.
- 131 comp. बद्धक् go beyond bounds, stray = Skr. बहिस् + क्क; Pr. बहिक्केर or बहिक्कर, H. बद्धके.
- 132 der. বিষয়ে be spread, a passive or intransitive, derived from the primary root বিষয়ে No. 225.
- 133 den. विराव् mock, jeer = Skr. N. विराव sound, noise; Pr. विरावेद्द or विरावद, H. विराव.
- 134 den. বিভাৰ become bad, perhaps connected with P. P. বিভাৰেন (বিভান?) wasted.
- 135 den. बीट scatter, spill = Skr. P. P. म. वह (for विद्व, as पत्तह for पत्तह, see No. 112); Pr. विदेश or विद्वर, H. बीट.

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- 136 den. बीत् pass = Skr. P. P. P. बीत, Pr. बित्त (like निश्चित्त for Skr. निश्चत, H. C. 2, 99; otherwise the preservation of त is not explicable); Pr. बितेद्द or बित्तद्द, H. बीते.
- 137 den. बेड्र enclose, surround = Skr. बेड्, Causal बेड्बित or I. cl. बेड्त, Pr. बेड्रें (H. C. 4, 51) or बेड्र (H. C. 4, 221), H. बेड्रें. The root is probably a denominative of an anomalous P. P. P. or some other derivative of the root विज्ञ or विज्. The so-called Causal shows its denominative form.
- 138 den. बजराव or बाराब go mad = Skr. N. बातुझ; Pr. बाजझावेर or बाजझावर, H. बज़्झावे or बाराबे. See my Comp. Gramm. § 25.
- 139 den. सात flee = Skr. P. P. P. अग्न, Pr. अग्न (cf. H. C. 4, 854), Pr. अग्नेद or अग्नद, H. आते.
- 140 den. भी म or भी म be wet = Skr. चश्च ; Pr. चिलंगेर, or चिलंगर, H. भी में or भी में (?). As to the loss of initial च, see my Comp. Gramm. 172. Compare the primary root भी ज in the Appendix No. 21.
- 141 der. सुन् be fried, be cooked, a passive or intransitive, derived from सून् No. 143.
- 142 den. संख or भोख or भोद forget, blunder = Skr. P. P. P. अह; Pr. महद (H. C. 4, 177), W. H. भूडी or भोडी, E. H. भूद or भोदे. Skr. अह = Pr. सुडू = मुख्य = मुख; the change of a to u caused by the labial bh. As to the change of u to o, see my Comp. Gramm. § 148.
- 143 den. ਸ਼ੁਰ fry, cook = Skr. P. P. ਮੁਚੇ (Pan 8, 2. 44); Pr. ਸੁਚੇਵ or ਸ਼ੁਰਵ, H. ਮੁਚੇ.
- 144 den. सह cover, gilt (i. e. encase by rubbing on) = Skr. P. P. मह,
 Pr. सह or (disaspirated) सह; Pr. सहद or सहद (H. C. 4, 126),
 H. सह. The Skr. root सह cover is adopted from the primitive
 Prakrit or Pali सह (= सह), whence सह a covering, hut, H. सह or
 सहा. Similarly are formed the roots कह, केंद्र, &c.
- 145 den. सत् consult = Skr. N. सन्त्र ; Pr. संतेष्ठ or संतष्ठ (cf. H. C. 4, 260 संतिष्ठ), H. सत्ते (with elided nasal, see my Comp. Gramm. § 143).
- 146 der. ਜਿਵ be effaced, cease to exist, a passive or intransitive, derived from the root ਜੋਫ, No. 153.
- 147 der. vie be shaved, a passive or intransitive, derived from the primary root vie. No. 284.
- 148 der. मृंद् be closed, a passive or intransitive, derived from the root मृंद, No. 151.
- This derivation I owe to S. Goldschmidt, *Prákritica*, No. 8, p. 9. Formerly, looking upon भाष or भार as the more primitive form, I was inclined to consider it a denominative of Skr. असर, whence comes Hindí भारा or भाषा a simpleton.

- 149 den. स die = Skr. P. P. पत, Pr. सुच (H. C. 4, 442); Pr. सुचद, H. सरे.
- 150 den. मून discharge urine = Skr. N. मूच; Skr. सूचवति, Pr. मुत्तेइ or सत्तर, H. मृते.
- 151 den. मूंड् close (lit. with a seal ring) = Skr. N. मुझ; Skr. मुझ्यति, Pr. मुद्दे or मृद्द, H. मूँदे. See H. C. 4, 401 दिशो सुद्द sealed.
- 152 den. सून be silent = Skr. P. P. मून (of root सू); Pr. मूचेर or सूचर, H. सूने, (or from N. सीन).
- 153 den. सेंड efface = Skr. P. P. P. बह, Pr. सिहेद or सिहद (disaspirated for सिहद, cf. Páli सह or सह = बह), H. सेंडे, (with e for i, see my Comp. Gramm. § 148).
- 154 den. सीख or सीर् blossom = Skr. N. सीख; whence सीखयित, Pr. सीखेर or सीखर, W. H. सीखे or E. H. सीर.
- 155 den. सीखाय or सीराय blossom = Skr. N. कीख; Pr. सोखावेर or सीखावर, W. H. सीखावे or E. H. सीरावे.
- 156 den. रज् be attached = Skr. P. P. P. रज्ञ, Pr. रज (H. C. 2, 10); Pr. रजोद्द or रजाद, H. रजे.
- 157 den. रंग् dye = Skr. N. रंग ; Skr. रंगयित, Pr. रंगेइ or रंगइ, H. रंगे.
- 158 der. ৰক্ be hindered, a passive or intransitive, derived from root বাৰু No. 162.
- 159 der. বয় or বহু be restrained, a passive or intransitive, derived from the primary root বয় No. 298.
- 160 den. इड or इड be angry = Skr. P. P. P. इड, Pr. इड (H. C. 4, 414) or इड, Pr. इड or इड्ड.
- 161 comp. रेंक bray = Skr. रेव् (acc. sg. neut. रेड्) + ख; Pr. रेक्केर् or रेक्कर, H. रेके.
- 162 comp. रोक् hinder = Skr. चष् (acc. sg. neut. चत्) + छ; Pr. चक्केर or चक्कर, H. रोके.
- 163 der. राष् stop, plant; a transitive or active, derived from primary root रष, No. 295.
- 164 den. संगद्ध limp = Skr. N. सह, Pr. diminutive संगद्ध ; Pr. संगद्ध or संगद्ध, H. संगद्धे.
- 165 den. सुन् or स्त्रो reap = Skr. N. सृन ; Skr. सृनयति, Pr. सृनेद् or सन्द, H. सृने or स्तिरे.
- 166 comp. wa disappear, conceal oneself = wy + w; Pr. wax (H. C. 4, 55), H. wax. The word wy properly means "dropping out", "elision"; it is derived from the Skr root wy break. This original meaning of the root is still preserved by the Pr. wax, which means both break, cut of, (H. C. 4, 116, where it is said to be =

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- Skr. तुर्) and disappear, conceal oneself (H. C. 4, 56, where it is given as an equivalent of the Skr. निकी) *
- 167 den. जुभाव or जुदाव covet, be enamoured with = Skr. N. जाभ ; Pr. जाभावद or जादावद, H. जुभाव or जुदाव, (with u for o, see my Comp. Gramm. § 25).
- 168 der. us be adorned, be prepared, a passive or intransitive, derived from root uts, see Appendix No. 24.
- 169 comp. सदस् or सदस् get away, disappear, conceal oneself = Skr. सद or सदस् म ह : Pr. सहस्र or सदस्, H. सदसे or सदसे. The word सद means covering, concealment. The root सद् becomes सद् in Pr.; see Vr. 8, 51. H. C. 4, 219.
- 170 der. বৰ্ be settled, a passive or intransitive, derived from the primary root বাৰ No. 336.
- 171 den. समुदाब be in presence of = Skr. N. संमुख; Pr. संमुदाबेद or संमुदाबेद, H. समुदाबे.
- 172 comp. सरक be moved, move = Skr. सर + क; Pr. सरकेर or सरकर, H. सरके. Possibly it is a mere variety of the root सङ्क.
- 173 den. सराष् curse, denom. made from the Hindí सराष a corruption of the Skr. आप; see my Comp. Gramm. § 135.
- 174 der. साठ or साँड or साँड combine, a transitive or active, derived from the primary root संड, No. 328.
- 175 den. शैख moisten = Skr. N. शौतक; Pr. शैचलेइ or शैचलइ, H शैसे. on the absorption of a after i, see my Comp. Gramm. § 97.
- 176 der. सुभर् be correct, mend, a passive or intransitive, derived from the primary root दुवार, see No. 346.
- 177 den. सुदाव be pleased or give pleasure = Skr. N. सुद्ध ; Pr. सुद्धावेद or सुदावेद H. सुद्धावेद.
- 178 den. सुदाव be beautiful or make beautiful = Skr. N. साम ; Skr. हामयति, Pr. योदावेद or सेहिन्द, H. सुदावे. This might, however, be a primary root, from the causal of root हाम.
- 179 den. सूच् or सुच् be dry = Skr. N. शुक्त, Pr. सुक्तेंद्र or सुक्त्रद्र, H. सूचें or सुच्
- 180 den. स्त्त sleep = Skr. P. P. पुत्र; Pr. सुत्तेई or सुत्तई, H. स्त्ते.
- 181 den. चैं त् or चें त् adjust = Skr. P. P. P. समास्ति, Pr. समास्ति (cf. H. C. 2, 99 निस्ति = Skr. निस्ति), Ap. स्वौदित or स्वौद्ति, H. (contracted) चैं त ; whence Pr. समास्तिद्द, H. चैं ते or चें ते.
- 182 comp. अन् evacuate = Skr. उद् + छ; Pr. उमार, H. अमे (for उने)?
- The root খুৰ might also be derived from খুৰ্ + 5, from the root খুৰ্ which (like খুৰ্) means both cut of and disappear. Or it might be derived from খুৰ্ + 5; the root খুৰ meaning become invisible.

- 183 comp. খৰাৰ or খৰাৰ bawl, drive away or keep off (with shouts) =
 Skr. খৰ্ + ছ; Pr. খুৱাৰই or খুৱাৰই, H. খুৱাৰ or খুৱাৰ. This
 is a pleonastic form of No. 187.
- 184 den. चंकार् bawl, drive away or keep off (with shouts) = Skr. चकार ; Skr. चकारवित, Pr. चकारेड or चकारेड, H. चंकारे. Connected with roots Nos. 183 and 187.
- 185 খন slay Skr. P. P. P. খন, Pr. খন (like বিভিন্ন H. C. 2, 99); Pr. খনির or খনর, H. খনী.
- 186 comp. ব্যাহ্ move = Skr. হয় + ছ; Pr. ব্যাহ্তির or ব্যাহ্তি, H. ব্যাহ্তি
- 187 comp. ছাৰ bawl, drive (with shouts) = Skr. ছক + ছ; Pr. ছলুত or ছলুত্ (H. C. 4, 134), H. ছাৰ. See Nos. 183, 184. Probably connected with root মন্ত or মান্ত or মা
- 188 den. चार lose, be beaten, be unsuccessful = Skr. N. चार, Pr. चारेद or चारद, H. चारे. H. C. 4, 31 has चारवर (for चारावर by H. C. 3, 150), said to be = वस्ति; it is merely a pleonastic form of चारे. Hindí has चरावे or चिरावे.
- 189 comp. हैं क् blow = Skr. सम + छ ; Pr. धमकोर or धमकार, Ap. धवँकार, H. हों के (for दोक). See No. 92.

APPENDIX .- Primary Roots.*

- 1 ऐंच् or रंच् pull, attract = Skr. जा + डाप्, future जानकाति (used in the sense of the present), Pr. जायंक्द् or जारंक्द् (H. C. 4, 187), H. ऐंचे or एंचे (with loss of aspiration). See introductory remarks, pp. 39, 40. This root occurs in the shortened form जंच both in Pr. (H. C. 4, 187 जंचर) and in old Hindí (Prithiraj Rasau 27, 38 जंचे); see No. 2.
- 2 a q or a q or a pull = Skr. aq, future mania (used in the sense of the present); Pr. a q or a q, H. aq, a or a q, with transfer of aspiration, see my Comp. Gramm. 132). On the inserted nasal, see ibidem §§ 149, 158, H. C. 1, 26, 28. On the change of a to ai or e, see my Comp. Gramm. § 148; here it occurred by assimilation to root q q or a No. 1. See introductory remarks pp. 39, 40. In old Hindí this root occurs in the form a q, which is much nearer the original Prákrit form a q; and corresponding to it, the old Hindí has a root-form a q which has evidently been modified from the original form a q (see No. 1), in order to assimilate it to a q; just as the original form a q has

[•] These are roots which I was at first inclined to consider to belong to the secondary class.

been modified to a in order to assimilate it to a. Thus the two forms and and occur in the Prithiraj Rasau 27, 38.

मां संतोख सकरी बीस डंकी बर मंत्रे। चीतेत्री सञ्चाल बात चरि प्रात सु मंत्रे॥ i. c.,

- "The Mangol Khán Lalarí draws twenty daggers, and the four-sworded Sabbáj pulls out the enemy's life with his arrows."
- 3 बांच vomit, let go, release = Skr. चूच, I. cl. बर्दात, Pr. चचुद् (H. C. 4, 91), H. बांडे. The root is also spelled बांडे; and it might be derived from चूच, VII. cl. कूच्ति, Pr. बंडर or बंडर, H. बांडे or बांडे (as Pr. अंजर for Skr. अनिक्क). It might also be derived from the Skr. denominative root ब्हे. X. cl. बरंबित; as it seems to have been done in H. C. 2, 36 (ब्रुड्स from ब्रुडि).
- 4 इप् be pressed down, be stamped, be printed = Skr. इंप्, I. cl. जन्मित, Pr. इंप्र, H. इपे. Or perhaps from जन, IV. cl. जाम्बति.*
- 5 अंच or अच or अच sigh, chatter (wildly), lament, be sorry for = Skr. आंच, I. cl. आंचित, Pr. अंचर (H. C. 4, 140), H. अंचे, अचे or (disaspirated) अके. As to the change of आ to आ, compare Pr. अची for Skr. अवः (H. C. 2, 27). As to the meaning, compare the English "croak." †
- 6 आंप throw on, cover = Skr. चप throw, Passive चप्पते (used actively), Pr. आंपर, H. आंप. The आ for च is as in आंपर for चीयते H. C. 2, 3, and the inserted anusvára, as in अंपर (H. C. 4, 2, 1, 26, for ज्यार). Or it might be derived from Skr. चिंच + च, Causal चध्यपैयति, Pr. अंपर or अंपर (for चळांपर, with loss of initial च see my Comp. Gramm. § 172).
- 7 डब् knock, hammer = Skr. तच्, I. cl. तचित, Pr. डक्डर (with ड for त as in डमरो H. C. 1, 205), H. डबे (for डचे with transfer of aspiration). Compare Skr. टक्टर. See No. 9.
- 8 डॉस् ram, hammer = Skr. तस्, I. cl. तस्ति, Pr. डस्ट् (as to ड for त, see H. C. 1, 205), H. डॉसें (for डसें, with transfer of aspiration from स् to ड, and change of स् to स्, see my Comp. Gramm. §§ 11, 132). See No. 10, also Nos. 7 and 9.
- 9 डोक् or डोक् ram, hammer, drive in, (nail, &c.) = Skr. लक्, I. cl. लक्ति, Pr. ड्क्डर् (as to ट for त, see H. C. 1, 205), H. डोक् or डोक् (for डोक्, with transferred aspiration). See No. 7.
- 10 डोस् or डोस् ram, hammer = Skr. बच, I. cl. बचात, Pr. डुक्द (cf. H. C. 1, 205), H. डोसे or डांसे (for डोसे). See No. 8.
- The root খুল্ also might produce a Pr. passive (used actively) ছাত্মই, analogous to ছিলই (H. C. 4, 257).
- † This verb is noted by Hemachandra not less than five times; in 4, 140 as = धतप repent, in 4, 148 = विश्वप lament or prattle, in 4, 156 = उपाद्ध म scold, in 4, 201 = विश्वप sigh, and in 4, 259 = भाष talk.

- 11 sty or sty send forth, pour out, cast, a modification of wig, No. 14 q. v., cerebralisation transferred to the initial w from w.
- 12 चप fix, settle = Skr. खन् ; Passive खन्मते (used actively), Pr. चपद् (formed similarly to क्पिट् from खुम्मते H. C. 4, 257), H. चपै. See footnote on p. 46; स्थ = च = प्य = प्य.
- 13 बाप or डप alap, strike, pat = Skr. सूच्, Passive सुद्धाते (used actively), Pr. बणद or डपद, H. बाप or डप. See footnote on p. 46; द्धा = अव = य = य = य.
- 14 wis send forth, pour out, cast = Skr. wie, I. cl. wien, Pr. wies (H. C. 4, 79), H. wis. See No. 11. The Skr. wis is adopted from the Pr., and is probably a denominative of we, P. P. P. of we glide, flow, Pr. we = we = wis.
- 15 फलंग् leap = Skr. त्र+लंघ, I. cl. प्रसंपति, Pr. पसंपद, H. फलंगे (with transfer of aspiration).
- 16 फेंक् or फींक् hurl, fling, throw away = Skr. प्र-इप, Future प्रेच्छित (used in sense of present), Pr. पेक्बइ or पेंचइ, H. फेंके or फींके (with transfer of aspiration).
- 17 विम् weave = Skr. इ. IX. cl. इचाति, Pr. विम्ह, H. विमे; see No. 19; also No. I, 237. The Skr. root for weave is बे, I. cl. वचति or IV. cl. जवते; it seems impossible to derive the H. root विम् from it; but the roots इ and बे are probably connected; both mean cover.
- 18 बिक् be spread = Skr. वि-स्तृ, Passive विश्वियते (for विस्तियंते; like क्रियते, त्रियते), Pr. विश्वेद or विश्वद, H. विश्वे. Compare Pr. विश्विद्ध in Chanda 2, 21 for Skr. विश्वीर्थ.
- 19 बुज् weave = Skr. ह, V. cl. हचोति, Pr. बुज्द, H. बुज, formed like सूज No. I, 347. See No. 17.
- 20 बोक्त् load = Skr. वस्, Passive जसते (used actively) or Causal Passive वासते, Pr. वज्ञाद (cf. H. C. 4, 245 बुझाइ), H. बोक्ते.
- 21 भीज or भी ज be wet = Skr. जाभ + चंज, Passive ज्ञास्त्रात, Pr. जानि जार, H. भीज or भी जी (with loss of initial ज; see secondary root भीज No. 140).
- 22 भूक or भोक or भोक talk foolishly, bark = Skr. अष, Future भाषाति.
 Pr. अक्षर (H. C. 4, 186, with disaspiration for भाषार), H. भूके, &c.
 The original aspirate form भोके occurs in Hindí. There is an identically spelled root, meaning thrust, drive, which probably has a different origin and may be a compound root.
- 23 भेज send = Skr. चिम + चज् , Passive चम्चचा (used actively), Pr. चिम्नचार, H. भेजे (with loss of initial च and change of i to e, see my Comp. Gramm. §§ 172, 148. As to the change of ya to i, see ibidem, § 121.
- 24 पान adorn, prepare = Skr. पंज, Passive पचते (used actively), Pr. पन्जर, H. पान. The Skr. root पन्ज् has been adopted from the Prakrit.

APPENDIX

TO "A COLLECTION OF HIND! ROOTS."

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ERRATA.

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Page 83, line 22, read budhya
                              for builhga.
    35, " 38, " Skr. eak
                               " Skr. sak.
            1, " বিবু
                               " बिर
    44, "
            6, " चोड्
    44, ,,
           80, "
    47,
                  भाद
    55, "
           17, "
    57, "
           19,
    57, "
           41, " सम्
    59, "
           33, " सड्
    59, "
           ३७, " सुट्, सुस्
    66, "
           80, )
           82,
                               " Skr.
                   Skr. N.
           85,
    75, " 13, " Skr. N.
                               "Skr.
                   Skr. N. जुप ,, जुप.
    76, "
           85, ,,
                               " सोभ.
                   ज्ञोभ
    77, "
           28, "
    77, "
                               " Skr.
                   Skr. N.
           37, ,,
                  Prithiráj
                               " Prithiraj.
           24, "
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CORRIGENDA ET ADDENDA.

Page 1, for Trichinopoli, read Trichinopoly.

- " 2, for stubi (passim), read stúbi.
- " 2, line 19, for purána, read púrana.
- " 2, " 20, (first word) for n read in.
- " 2, " 5, from bot., for a high, read high.
- , 3, , 12, from bot., add the following note:-

'The projecting beam ends are perhaps carved to represent Yáli (? Griffins') heads, and the spiral lumps noticed may be the Yáli's trunk coiled up above.'

Page 4, line 6, from bot., for Nachaiyar, read Nachaiyar.

- , 5, ,, 14, after metal add, somewhat like the Sabha (halls) at Chidambaram.
- , 5, ,, 8, from bot., insert an asterisk (*) with foot note:-

On a 2nd visit the former (upper) head appeared to be that of a ram with very curved horns, and its leg and foot cut off and put in its mouth as they still often do at village sacrificial feasts. The buffalo's head below has its tongue hanging out of its mouth.

Page 6, line 1, after Gram-munsif, insert or village officer.

- " 6, " 17, after new, insert Jaina.
- " 7, " 12, for Kasi read Kási.
- , 7, , 10, from bot., after or, insert Coleroon.

2nd paper p. 8.

Page 8, line 12, for flat silled read flat-silled.

- , 8, ,, 5, from bot., for shutter stone read shutter-stone.
- , 9, , 13, for nehropolis read necropolis.
- " 9, " 19, for similar read kistvaen.
- , 9, ,, 13, from bot., for chadud read chathut.
- " 9, last line, for Neilipatla read Nellipatla.
- , 10, line 7, for three or four read six or seven.

B. R. BRANFILI.



ABBREVIATIONS.

Bs. = Beames' Comparative Grammar.

Cw.=Cowell's edition of the Prákrita Prakása.

DL = Delius' Radices Pracritica.

E. M. = E. Müller's Beiträge zur Grammatik des Jainaprákrit.

H. C. = Hema Chandra's Prákrit Grammatik (ed. Pischel).

K. I. = Kramad Isvara's Prákrit Grammar.

R. M. = Dr. Rajendralala Mitra's Prákrit Vecebulary. S. B. = Setubandha (ed. S. Goldschmidt).

S. C. = Subha Chandra's Prákrit Grammar.

 Gdt. = S. Goldschmidt's edition of the Setubandha.

Spt. = Saptaşataka des Hála (ed. A. Weber).

T. V. = Trivikrama's Prákrit Grammar.

Vr. = Vararuchi's Prákrit Grammar.

Wb. = Weber's edition of the Saptasataka.

G. = Gujarátí. S. = Sindhí. M. = Maráthí.

Coins supplementary to Thomas' Chronicles of the Pathan kings.—By
C. J. Rodgers.

(With two Plates.)

The "Chronicles of the Pathan kings" is a very full work. But it is an enlargement of a smaller previous work. Further search brought more coins to light, and the description of these coins has swollen the original treatise to its present size. But large though the work be, it is not exhaustive. Finality in our knowledge of the coins of the Pathans has not yet been attained. Continued search will bring out still further coins which from time to time will have to be described. Owing to the nature of my duties I have few opportunities of obtaining fresh coins, but as I have during the past year come across about forty unpublished ones, I thought I might venture to put them forward as a small contribution to a further knowledge of the coins of India.

The word a'dl figures largely on the coins of the Gazní rulers. In some modern coins this word occurs together with the sword on several coins of towns in Afghanistan. It must have been for the reason, that might is right, that the early conquerors of India stuck this word on their coins. In Plate V, Nos. 1 and 2 have a'dl on the obverse and mumalliki on the reverse. I am inclined to ascribe this coin to Muhammad Sám or his general Eibek. The word I have transliterated as mumalliki may be mumlakat. No. 6 I regard as a coin of Muizz-ud-dín Muhammad Sám. The word Muizz on this coin is written more like the same word on the coins of Eldoz and of Muhammad Sám, than that on the coins of Muizz-ud-dín Kaikubad or Muizz-ud-dín Bahram Sháh. There is a coin in the "Ariana Antiqua," Pl. XX. fig. 14 which is not mentioned by Thomas. Now I got a good specimen of this same coin from Neshápúr with a lot of the coins of A'la-ud-dín Khwárizmí. A glance at No. 15

of Plate V, will show that this very king A'la-ud-dín struck coins of the very same type, using the square area for his name and titles and dividing the latter similarly to Muizz-ud-dín. No. 7, Pl. V, I claim also for Muhammad Sám. It has Muizzí on obverse and on reverse in Hindí, Srí Samanta Deva.

Nos. 3 and 4, Pl. V, are undoubtedly new types of Shams-ud-dín Altamsh. No. 3 has obv. a'dl, rev. Shamsí. No. 4 has the same with a star underneath each word. Neither has any ornament.

No. 9 is, I believe, also Shams-ud-dín's. The star seems to indicate this. A'dl i Sultan ul Muazzim, the inscription on the obverse is found also on a large quantity of coins of size similar to this one of which Thomas takes no notice. But the Zarb ba Lahore with star above it is not on them. They have always Zarb ba hazrat Dehli. No. 9 is to me unique. But the other kind I mention are very common indeed. In my own small collection I have no less than 12 duplicates. One of them has A'dl i Sultán i Muazzim; the alif and lám are altogether missing.

No. 10 is undoubtedly Shams-ud-din's coin. Obverse: A'dl us Sultán (ul A'zim); Reverse: (Sha)ms ud Dunya (wa) ud din. This is a very coarse coin.

Nos. 11, 12 and 13 are I think Shams-ud-din's. The obverse and reverse are simple A'dl and Dehli. No. 11 has these words in square areas; No. 12 in round ones with ornaments; No. 13 in a hexagonal star, with dots in the angles.

No. 5 is a very rare coin weighing only the same as No. 109 in Thomas, and half the weight of his No. 52, the inscriptions of which latter coin it possesses. So we may regard this coin as the smallest hitherto discovered of Shams-ud-dín's. It is exceedingly rare as is the one double its size. Thus in all I have had the pleasure of unearthing no less than 10 new types of coins of Shams-ud-dín.

No. 8 I ascribe to *Reziah*. In the rayed circle is the name *Reziah*. On the reverse is the *bull* with Samanta Deva above it in Hindí. The whole coin is similar to No. 7 of the same plate.

No. 14, Plate V is evidently a coin of the same king the No. 15 belongs to. And No. 15 is obv. A'la ud Dunya, rev. Wa ud din. This is a coin of A'la ud din Khwarizmi. No. 14 has similar inscriptions to those on No. 5; but the fortunate discovery of No. 15 settles the ascription.

No. 16 is a new coin of the same king. In the central area is the word Sultán and on the margin Ul A'zim A'la ud Dunya wa ud dín Muhammad (bin us Sul)tán. Reverse: the Kalimah. The whole is in Kufic characters.

Not one of these three coins is in the British Museum or is noticed by Thomas.

No. 17 is a coin of Fíroz Sháh Zafar, son of Fíroz Sháh. The obverse has on it in square area Fíroz Sháh. The margin reads Zafar ibn Fíroz Sháh Sultán, the reverse has náib i amir ul Mominín 791. No. 18 is exactly the same in date and inscriptions, but the latter are arranged differently on the obverse. Zafar beginning above the area and not on the left hand side as in No. 17. They are both of silver and copper. This Zafar Khán, son of Fíroz Sháh, died in Gujrát in 775, A. H. But he had a son also named Zafar Khan, and this coin may have been struck in his honour after the death of Fíroz Sháh.

No. 19 is a coin of Muhammad Shah, son of Firoz Sháh. It is not in Thomas in this size. This coin is very light. In reading the margin of the large coin of this type, Thomas omits the word Sultán which is always on the best preserved specimens. The centre area is Muhammad Shah. The margin reads from the outside and is Sultán, zarb bahazrat i Dehli. The reverse of this coin is Naib i Amír ul Mominín 792.

No. 19a is a coin of similar type without any date on the reverse. Insemuch as the margin of this coin reads from the inside, I am inclined to ascribe this to Muhammad bin Farid Shah, whose coins, when similar in type to the coins of the son of Firoz, have always some difference in the arrangement of the words.

No. 20 is a coin of Muhammad Sháh son of Farid Sháh. The inscriptions are, obverse Sultán Muhammad Sháh, Farid Sháh zarb Dehli. Reverse Khalifah Amír ul Mominín Khallad Khiláfotahu. There is no date. There is some uncertainty as to the date of the death of this king. Thomas, quoting Badaoní, gives his death as 847. I got a coin of this king's during the time this plate was being prepared, dated 848. But this does not prove much; for from the time of Fíroz Sháh, the mints kept en coining in the names of kings who had been long dead; e. g., Mubárak Sháh died in 837. And I have coins bearing the date of 840 and 854. A whole series of posthumous coins of these kings might easily be made.

No. 21 is a coin of Bahlol Sháh. The inscriptions are, substituting Bahlol Sháh for Muhammad Sháh, similar to those on the last coin. Coins bearing these inscriptions are somewhat rare in the smaller size. This large-sized coin is to me unique, and it has not as yet been published. This is the third new type of Bohlol's that I have brought to light.

No. 22 has no business in this plate. It was put in to fill up a gap, and because I saw that the coin is new to numismatists, as it is not in the British Museum Catalogue or in Thomas' work on the Gazní coins. It is a binominal coin, struck evidently by Bahrám Sháh. Obverse:—A'dl we Sultán ul Azim Bahrám Sháh. Reverse:—A'zd us Sultán ul Muazzim Sanjar. Here Bahrám seems to arrogate to himself the title of A'zim "the greatest" and to give his ally (A'zd) Sanjar who had helped him to retain

his throne only the title *Muazzim* "the great," or "great," simply. Grammatically there is an apparent slight, but conventionally the title of Sanjar is as honorable as that of Bahrám. There is a difference, we know, for Muizz ud dín Muhammad bin Sám during the lifetime of his elder brother Gyás ud dín Muhammad bin Sám always used in his coins *Muazzim* for himself, until his brother's death when he took the title *ul A'zim*. But as I have shown above, Shams ud dín used the title *Muazzim*, as did also *A'la ud dín Masaud*; for I have two unedited small coins of his. Some two months ago I came across a find of Gazni coins in the Umritsur bazaar. There were about 500 in all. They contained several new types of Masaud III, Malik Arslán and Bahrám Sháh. The present war should cause some thousands to be unearthed and we may expect novelties for some time to come.

I now proceed to examine the coins in Plate VI. The first one is a small Kashmiri coin with the date (8)74 on it. It is a coin of Haider Sháh and confirms my statement in my paper on the Kashmir Sultans, that this king was reigning at that time, although his accession is usually marked in 878.

Nos. 2 and 3 are very pretty little novelties, of Muhammad Sháh and Sikandar Sháh. They are of copper. Obverse:—names of kings. Reverse:—the title Sháh. They are much smaller than Gyas ud dín's coins with similar inscriptions. They were evidently a revival of the small coins of Shams ud dín and Nasir ud dín Mahmúd and Muizz ud dín.

Nos. 4 and 5 are two anonymous coins of Humáyún, bearing the date 946. No. 4 was struck at Agra.

No. 7 a rupee, full sized, of Humáyún's, struck after his return in 962. It resembles very closely, in its get up, the rupees of Muhammad Súr. As yet all the silver coins of Humáyún which have been described have been thin and light, after the fashion of the tankahs of Central Asia. The inscriptions are very distinct. Obverse Area:—Muhammad Humáyún. Bádsháh Gází 962. Margin:—Us Sultán ul Adil Abú ul Muzaffar, Zarb (Dehli?). Reverse Area:—the Kalimah. Margin;—names and titles of the four companions of Muhammad.

No. 8 is a rupee of Muhammad Sháh of Bengal. Obverse Area:—Muhammad Sháh Sultan Gází, Khallad allah mulkahu wa Sultanahu; margin:—Shams ud Dunya wa ud dín abu ul Muzaffar, Zarb, Satgáon. Reverse Area:—the Kalimah, with a star; margin:—the names of the four companions and their titles together with the date 962. There is a difference between the titles of Umr in the above two rupees. In Humáyún's it is Al Fárúq, in the Bengal one al Khattáb.

No. 9, a new type of Baber's silver coins. It is of the tankah kind, but of uniform thickness and well struck, unlike most of the coins of

Baber. Obverse:—Zahír ud dín Muhammad Bábar, Bádsháh Ghózí (9)37. Khallad allah mulkahu wa Sultánahu, zarb Agrah. (The bars and knots are not peculiar to the Kashmir coinage. They are found on the anonymous coins of both Baber and Humáyún). Reverse Area:—the Kalimah; Margin:—names and titles of the four Companions.

Nos 10, 11, 12, are three varieties of a new type of Humáyún's anonymous coinage. They were all struck at Champánír. Firishtah spells this word جانپاني. The coins all agree in giving it جانپاني. The inscriptions of these coins give a new feature—a title to a city. Champánír is entitled the noble city Shahr i Mukarram. It speaks well for Humáyún's nature that he could so style a city he had just conquered; for the date of the coins is that of the conquest of the city 942. These coins too introduce a second new feature in Humáyún's anonymous coinage. Instead of Fí ut táríkh, they have ba táríkh. Obverse:—Zarb Shahr i Mukarram. Reverse:—Champásír ba táríkh 942. No. 11 belongs to Dav. Ross, Esq.

No. 13 is another of the anonymous coins of either Baber or Humáyún. I give it for two reasons: (1) It has full inscriptions. (2) The bar running across the Jaunpur anonymous coins resolves itself into a word Matabarrak, the title of the city—the Blessed. Obverse, Ba Dár al zarb Khitta i Jaunpúr Mutabarrak. Reverse:—Fi ut táríkh san 937; ornaments at the top and bottom. Most of the coins of Jaunpúr have a star on the obverse of one kind or other. But all have the bar, with the first letter and last one missing. All I have, have dar ul zarb on them too, although this is omitted by Thomas. The bars on some of the other anonymous coins may by the discovery of fuller specimens turn out to be some words or other.

Nos. 14, 15, 16, 17 and 18 are small copper coins of the Súrí family, forming of themselves a little set, out of which only one, No. 17, has been noticed by Thomas. No. 15 is the first of the set. Obverse:—Khalifah az Zamán 947. Reverse:—Sher Sháh us Sultán. This is a very small coin indeed for Sher Sháh.

No. 16 is also Sher Sháh's, but it is larger and heavier than 15 and has a different inscription. Obverse:—Sultán Khalífah uz zamán, Reverse:—Sher Sháh ul A'dil Sultán.

No. 17 is Islám Sháh's, noticed by Thomas, No. 364, p. 418. I have given it here to complete the set at one view. No. 18 is Muhammad Sháh's Súrí. Obverse:—Sultán Muhammad A'dil Sháh: Reverse:—Khalifah uz zamán Abú (ul Muzaffar).

No. 14 is Sikundar Súri's. Obverse:—Khalifah uz zamán 962. Reverse: Sikandar Sháh us Sultán 962. Thomas does not notice any halves of the large copper coins of any of the five Súri kings. Halves of Sher Sháh are common, those of Islám Sháh are rare, those of Muhammad Kdil

Sháh are extremely rare, while I have only seen one of Ibrahim Sháh and not one of Sikandar Sháh's. General Cunningham had a large copper one of Sikandar Shah. Mr. Delmerick published one of Ibrahim's. The large coins of the other three are common, the greater numbers of course being Sher Shah's and Islam's. I have not as yet come across a small coin of Ibrahim's. This is one of the things I am looking for. The Sikandar Sháh, whose coin is given in this plate No. 2, I believe to be the one who reigned in 795 for 45 days. A comparison of this coin with No. 275. p. 811 of Thomas, of which I have a most perfect specimen, leads me to this conclusion. Now if a king who reigned only 45 days could in that short time get out no less than five kinds of coins, I think we have a right to look out for the same number of varieties in the coins of kings who reigned longer. Scientific and systematic search with duly chronicled results ought to lead to much fuller knowledge respecting the coins of the Pathán's and their successors, and indeed with respect to the whole of the coins of the Empire of India from the time of Alexander the Great and Chandra Gupta to the times of Her Most Gracious Majesty the Empress of India and Queen of England.

As old coins are found, they find their way into the bazaars, where, if there is no purchaser at other than bullion rates, they are ruthlessly melted down, the silver being good, in order to supply metal to the makers of jewels. In this way undoubtedly thousands of coins disappear annually of which our museums and cabinets are standing in need. Meanwhile inasmuch as no Indian museum has its coins catalogued, no one knows what any collection may contain or may be in need of. Collectors would undoubtedly often present coins to museums which want them, if these wants were known. Students cannot use our Indian museums profitably until they know what the museums contain: and yet the end and object of all museums is an educational one. Hence I cannot help bringing this matter forward as one of the greatest importance in making our museums more useful in the promotion of historical studies.

Several other new varieties of coins including a rupee of Shams ud din Altamsh, a tankah of silver of the same king with rays round one side to represent the sun (Shams), a new variety of Reziah's and one of Kutub ud din Mubárak Sháh's together with several others must stand over to a future paper, in which I hope to be able to show that No. 158, p. 190 of Thomas was struck in Talang (Telingana), just the same as No. 11 of Plate IV of the Society's Journal of last year.

Memorandum on Coins of the Sunga Dynasty.—By H. RIVETT-CARNAC, Esq., C. S., C. I. E., F. S. A.

(With three Plates.)

I have to offer a few remarks on some more coins of the Sunga Dynasty submitted for the inspection of the Society.

Plate VII, No. 1 is a coin of quite a different type from those already sent. Mr. Carlleyle reads the inscription on it as Ramadata.

- No. 2, A and B are 2 small coins with the legend Achya or Bhangs. (Mr. Carlleyle.) On the other side is what looks like the Buddhist wheel.
- No. 3. The legend on this coin of Bhanu Mitra corresponds with that on the large coins already submitted to the Society and described by Mr. Carlleyle. The shape of the coin is, however, different, and a figure which Mr. Carlleyle takes for the Nirvána has been stamped in above the legend. There may, however, perhaps be some doubt whether this is intended for a recumbent figure of Buddha. It looks indeed more like a standing female figure on a low platform, a figure somewhat resembling that on the coin of Phaguni Mitra to be noticed later.
- No. 4 is a similar coin. The legend not being in quite such good preservation.
- No. 5 is a coin of Agi or Agni Mitra of the same type. In this specimen, however, the figure would seem to be that of a female, the bosoms being distinctly shewn. It is not unlike the rough representation on the Kanauj series of coins, see Plate XXIV, Vol. I, Prinsep.
- No. 6, A, B, C are 3 small coins of the same type. The figures are distinct enough, but the inscription in each case is undecipherable.*

I have already sent to the Society, in illustration of Mr. Carlleyle's paper, specimens of each of the various coins of the Sunga Dynasty. The specimens sent were specially selected on account of the legend and the marks stamped on the obverse. The design on the reverse is hardly of so much importance, but it may be interesting to notice the Monogram or device chosen by each king. From a large number of specimens I have selected those now sent to illustrate as far as possible these points. Unfortunately none of the specimens are in very good preservation. The coins when found looked most hopeless. (See No. 7 specimen in its original condition now sent.) But by a careful process of boiling and cleaning the legends and stamps on the reverse have been rendered sufficiently clear.

^{• [}They are probably coins of Sárya Mitra. On No. 6 B, the letters s, y, m, and on No. 6 A, the letter s can be distinguished. Ed.]

It is a curious fact that in hardly any case has it been possible to preserve the design on the reverse. Under the process of cleaning, what I may call the back of the coin has almost invariably flaked away. And this will hardly be wondered at when the condition in which the coins were originally found is seen.

The devices of the different monarchs may be noticed as follows:

Bhumi Mitra. The coins of this king, besides being very numerous, are nearly all in fairly good preservation. The device on the reverse is distinct. A standing figure on a platform, between two poles or pillars of victory, or whatever they may be called, each staff surmounted by three cross-bars, and the head surrounded by rays or flames. In the specimen No. 8 the figure holds what looks like a snake in its hand. The snake or line is not so distinct in all the coins (see Nos. 9, 10).

Agi or Agni Mitra. The coins numbered Nos. 11, 12 in Plate VIII bear nearly the same device as those of Bhumi Mitra. And of this king also it is to be noticed, that the coins, besides being numerous, are, comparatively speaking, in excellent preservation. Here also is a figure with rays or flames issuing from the head. This figure also stands on a platform between poles or staffs of victory. But in this case each staff is surmounted by what looks like a thistle or a ghara, whereas in Bhumi Mitra's coins at the summit of each staff are, as already noticed, three cross-bars. The smaller of Agni Mitra, Nos. 13, 14, 15, exhibit a different device. The standing figure has in its hand what would seem to be a snake. There are no square platform and no side poles. At the base are rays or flames.* In fact the device is nearly the same as that on the coins of Phaguni Mitra now to be noticed.

Phaguni Mitra, Nos. 16, 17, 18, 19. These coins also are numerous and fairly well preserved. The device shews a standing female figure surrounded by what look like rays or flames.* In the right hand is a club (?), lower down and also on the right side a device or monogram is clearly distinguishable.

The coins of Bhadraghosa, Surya Mitra and Bhanu Mitra, which, together with Phaguni Mitra, are, I understand, not only new coins, but also record the names of kings hitherto unknown, are much less numerous than those first noticed and are not generally in such a good state of preservation as those of Bhumi, Agni and Phaguni. Those of Bhadraghosa indeed are in most cases scarcely legible. And had it not been for the beautiful little specimen which came into my hands before the find in Bareilly, there might have been some difficulty at first in establishing the legend on these

^{• [}The base rather resembles the lotus-seat on the reverse of some Gupta coins, Ed.]

coins. Not one single specimen shows, with any distinctness, the design on the reverse. Two of the best in this respect that I have, are marked Nos. 20, 21. On these a female figure, resembling that on the coins of *Phaguni Mitra* can just be made out.

Bhans Mitra. The device on Nos. 22, 23 is tolerably clear. The sun with pointed rays surmounts a semicircle which may be intended to represent a serpent. Below is what may be taken for a squat figure supporting the sun (?) but the device is perhaps hardly sufficiently distinct to admit of any very satisfactory conclusion being drawn. This may possibly be aided by coins of other types in the possession of the Society or figured in books which are not at my disposal.

Surya Mitra, Nos. 24, 25. Here, as the name denotes, is the sun surmounting what would seem to be a triangular-shaped altar with the staff of victory on either side. Here also the staff has the cross-bars as in Bhumi Mitra's coins.

To these I have added a coin of *Indra Mitra*, No. 26, similar to those already sent. This coin has I believe been found before. The device on the reverse is somewhat different from those already noticed, and shows a standing figure on a square platform, like that on the coins of *Bhumi* and *Agni Mitra*. In the right hand of the figure is a sceptre? The Staff of Victory noticed in the other coins is wanting here.

It will be seen that of the seven kings whose coins are noticed above, six of them adopted a different device. As regards the coins of Bhadra-ghosa, it is not possible to speak with certainty. It will be noticed too that these six Mitras have all included the sun, or the rays of the sun on their coins, suggesting possibly their Mitra or Mithraic origin. The symbols on the obverse of the coins have been described by Mr. Carlleyle, and in all cases the design is the same or nearly the same. There is little or no difference in the shape of the letters used. The legend is surmounted by three symbols which are in all cases the same, although in the coins of Bhadraghosa and Bhanu Mitra the central symbol appears to have been punched in separately. All this would seem to suggest that these seven kings belong to the same dynasty. Mr. Carlleyle has attributed them to the Sunga kings, who, according to Prinsep and other authorities, commenced to reign over Magadha about 172 B. C.

I shall be glad if the Society can afford me any information regarding these kings—the succession in which they reigned and the probable dates of the coins.

In Prinsep's list Agni Mitra appears next after Pushpa Mitra the first of the line. And this arrangement coincides with that given by Wilford and others in the Asiatic Researches. If the condition of the coin and the quantity in which it is found are of any significance, then Agni

Mitra might fairly be supposed to be one of the most recent of these kings.

I have no suggestions to offer regarding any of them, save Bhadraghosa. It will be seen from Prinsep's list and also from Wilford's Essay in Asiatic Researches, Vol. XI, that one Ghosa Vasu preceded Vajra Mitra. Regarding this Vajra Mitra, Wilford in his Essay on Vikramaditva and Salivahana (see Asiatic Researches, Vol. IX, page 145,) writes as follows: "The first Vicramáditya is mentioned in the Cumáricá-c'handa; in which it is declared that after 3020 years of the Cali-yuga had elapsed, then would Vicramárca appear. He reigned fourteen years, and of course died in the year 3034, when the era of Yudhishtir ended and his own began. In the list of the kings, who were to appear in the Cali-yuga, to be found in the Bhágavata, Brahmánda, Váyu and Vishnu Puránas, there are two kings, the seventeenth and eighteenth in regular succession from Chandragupta, who reigned seven years each. The first is called Vicrama, and the other Mitra; and they are supposed to have been originally meant for Vicrama mitra who, according to some, reigned fourteen years; and in these lists, the father, or predecessor of Vicrama, is called Ghosha Rája or the king of thickets, which is another name for Gandharupa, or Gadhá-rája in the west. This looks like an interpolation; and the more so, as it will appear hereafter, that Ghosha-Rája died in the year 440 of our Era."

The Vajra Mitra of Prinsep's list is here supposed to be Vikrama Mitra or Vikramáditya, whose father and predecessor is Ghosa Rája. Wilford thinks that this name Ghosa looks like an interpolation. But perhaps the discovery of a coin belonging to this period, bearing the name of Ghosa, may help to establish the correctness of the entry?

It is perhaps also worthy of notice that Prinsep's list of the Kanwa Dynasty gives the name *Bhumi Mitra*, a contemporary of Vikramáditya. The coins of *Bhumi Mitra* and *Bhadraghosa* are certainly of about the same period, and possibly of the same dynasty. I am aware that since Wilford and Prinsep wrote, Mr. Thomas, General Cunningham and others have done much to clear up the doubts existing in respect to early Hindú Chronology. I am in hopes that those who are better informed than myself on the subject may be able to draw some practical conclusion from the coins which I have been able to collect.

I may add that the mass of them have now been tolerably well cleaned. They have been carefully examined and read by Mr. Carlleyle and myself, but no new types save those sent to the Society have been found. They are entirely at the disposal of the Society if they wish to see them, and I hope that a complete set may be accepted for the Society's Museum. The only reservation I have to make is, that a complete selection of the best specimens should be reserved for the British Museum, which Institution ought, I think, to have the first choice.



ASIATIC SOCIETY OF BENGAL,

Part I.-HISTORY, LITERATURE, &c.

No. III.-1880.

Remarks of the Afghans found along the Route of the Tal Chotiali Field Force, in the Spring of 1879.—By LIEUT. R. C. TEMPLE, B. S. C., F. R. G. S., M. R. A. S., &c. (With 3 Plates and 2 Maps.)

PART I.

This is the last of a series of papers on the march of the Tal Chotiali Field Force in the spring of last year, and closes my observations on the subject.* As the range of observations to be made along an entirely new and unknown route such as this is necessarily large, I found it impracticable to connect them all into one paper, and this has obliged me to repeat in the several papers certain remarks which were necessary to the exposition of the subject-matter of each, and I trust therefore to be excused for repeating here much that is to be found elsewhere. I have also again to make

 Journal of the march of the 2nd Column of the Tal Chotiali Field Force communicated to the Quarter Master General in India.

An account of the march of the 2nd Column Tal Chotiali Field Force, to the R. G. S., with map.

Sketch Map of the march of the Tal Chotiali Field Force, published by the Surveyor General of India.

Notes on the Formation of the Country passed through by the Tal Chotiali Field Force, and Rough Notes on the Distribution of the Afghan Tribes about Kandahar, to this Society.

the excuse to be found in all my papers on this subject that my notes were from the nature of the circumstances under which they were made necessarily of a rough and hurried kind and contain doubtless many mistakes, but as it seems the route is to be abandoned, it is likely to be a long while before it is again traversed throughout, and I hope therefore my notes will be found to be of value.

The geography of the route, thanks to the exertions and reports of the officers of the Survey of India* who accompanied the Force, is now well known and needs no remark here. Suffice it to say that the Force was sent from the Pishin valley towards Dera Gházi Khán viâ the Kákar country and Ba'rkho'm to open up what is known as the Tal Chotiali Route, and that the present writer was attached to the 2nd or principal column of the Force. The route taken and referred to herein is shewn in detail in the map attached, which was published for me by the Surveyor General of India, and in its general aspect in the map attached to my paper on the Geology of the Route in a former number of this Journal.†

II. The Tribes en route.

Before proceeding to discuss what was seen of the various tribes of Afgháns along this march, it may be as well to give a brief account of what is known of the vexed question of the origin of the Pathán and Afghán Tribes.

The people of the nation known in India as the Pathán Tribes call themselves Bani' Isra'i'L or Pukhtu'n (pl. Pukhta'na), and the Afghans, as a race of these Pathán Tribes, claim descent from Ta'LU'TI or Sa'RU'L (the Saul of the Bible) as their ancestor. According to native accounts Sa'RU'L had two posthumous sons BABAKI'A (BABACHIAH) and IBAMI'AS (JERE-MIAH), both born in the same hour of different mothers of the tribe of LA'WI' (LEVI). They rose to high postitions under David, Saul's successor; thus Barakía became prime minister and Iramía Commander-in-Chief. In SULIMA'N'S (Solomon's) time they were succeeded in their posts each by his son, Barakia by Asar and Iramia by Afgha'na, and Afghana is said to have had the building of the BAITU-L-MUQADDAS or Temple of Jerusalem. Asaf left 18 and Afghána 40 sons, and these founded important families or tribes. When the BAITU-L-MUQADDAS was destroyed by BAKHTU-N-NASE (Nebuchadnezzar) the Afghána Tribe, adhering to their forefathers' religion, were banished from Sha'm (Palestine) and took refuge in Kohista'n-i-Ghor and Kon-I-FIROZA. Here their neighbours called them Afghán (or Aoghán)

[•] J. A. S. B., for 1879, paper by Major Waterhouse.

[†] J. A. S. B., for 1879, Vol. XLVIII, Part II.

[†] Raverty. Gram. of Pushto. Introd. 1860.

[§] BIRKIYA and Armian according to Raverty.

or Baní Isráil. From Ghor by degrees the Afgháns extended to the Kohista'n-I-Ka'bul, Kandaha'r and Ghazni.

Until the advent of Muhammad the Afghans followed the religion of the Pentateuch or TAURET KHWA'N. But in the 9th year of the announcement of Muhammad's mission they heard of him from one of the Baní Isráil by name Kha'LID-BIN-(or IBN)-Wall'D. A deputation was sent to Medina under one Kais (also Kish, Kesh or Kaish) a leading Afghan, who became a zealous Muhammadan and received several special marks of the Prophet's favour, among which the title of malik or king, originally conferred by the Almighty on Saul, their great ancestor, was conferred individually on the Afghans.* Arabic names also were given them; thus Kais was called ABDU-R-RASHI'D (Servant of the Wise). And to him was also given the title of PIHTA'N (PATHA'N) meaning in Syriac a rudder, signifying that he, Kais, was the pilot of his people. From this Kais are deseended all the Afghan Tribes properly so called, and all Afghans are Patháns, the name by which the nation is most generally known in India. But there are many tribes who are Bani Israil and Pukhtun (Pukhtana) who are not Afghans.

The Pukhtún, erroneously known in India as the Pathán Tribes, then are divided into those descended from Kais and those who are not. Those who are so descended are generally known as Afgháns and the others as merely Patháns, though the whole nation is also known as Patháns.

The following is a list of the principal tribes of the present day generally acknowledged to be Afgháns:

1.	Duránis.	8.	Túris.	15.	Mangals.
2.	Tarins.	9.	Zaimukhts.	16.	Jadráns.
3.	Kákars.	10.	Orákzais.	17.	Shinwáris.
4.	Ghilzais.	11.	Dáwaris.	18.	Mómands.
5.	Povindas.	12 .	Khóstwáls.	19.	Yúsufzais.
6.	Wazíris.	13.	Afrídis.		(Kóhistánis.)
7.	Shíránis.	14.	Tájís.		

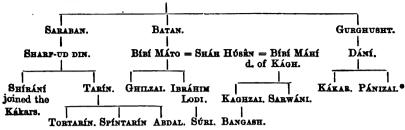
Kais married a daughter of Kha'lid-Bin-wall'd by whom he had three sons, Saraban, Batan and Gurghusht and from them descend some of the principal tribes above mentioned, as may be seen by the accompanying genealogy.

[•] At the present day the head of a Pathan family or tribal subsection is called malik.

[†] There are several legends to account for the names of Afghan and Pathan, that above given in the text is the commonest. The following are, however, worth noticing.

The word Pukhtán (Pukhtána) is said variously to be of Ibra'ní or Ibra'niní (Hebrew) and of Su'ela'ní (Syrian) origin, and to signify "delivered" or "set free."

KAIS = d. of KHALID-BIN-WALID.



The above genealogy which must of course be taken for what it may be worth, includes a good many of the ancestors of the present Afghán Tribes, but not by any means all. Each, however, has its own genealogical legend. It will be observed that the Duránis, the chief or largest tribe are not included in the above genealogy.

The Pathán Tribes we have to deal with in this paper are the Duránis slightly, and with the Taríns, Kákars, Lúnis and Zarkháns more fully. Of

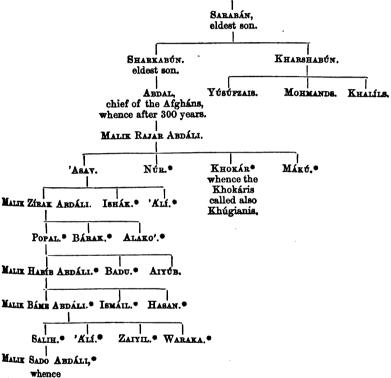
The common tradition about Afghán is, that the mother of their ancestor Afghána gave him the name because of her exclamation on the favourable answer to her prayers in the pangs of childbirth for a quick delivery, for she said on the birth of the child, "Afghana (I am free)," this being the traditional interpretation of the expression. Another tradition is, that she called out in her pangs "Afghán" or "Fighán" an expression of pain in the Persian language. According to the Kákar legends "Pathán" is a corruption of PRET KHÁN, the title given to the Kais above mentioned by the Prophet. Raverty in the Introduction to his Grammar of Pushto gives an extract from the TAZKIBÁT-UL-MULÚK OF History of the SADDOZAIS according to which the words Pushro (or Pukhto) and Pushtún (or Pukhtún) are derived from Pusht or Pasht the name of the place Afghana first fixed on as his residence on leaving Palestine. In the same work a characteristically oriental derivation of the word Afghána is thus given. "The original meaning of Afghánah is fighán, a Persian word which means complaint, lamentation, because he (KAIS) was a cause of lamentation to the devil, the jinns and mankind. From the constant use of the word the vowel point Kasrah was dropped after which the other letters could not be sounded without the aid of a vowel and alif-i-wasl was placed before the gh and thus made Afghanah." And the term Pathan is further derived from batan or patan which in Arabic (يطان) signifies the keel (Raverty says keelson) of a vessel, "without which it cannot sail, neither can the ship of war sail along without the keel of battle."

* The true Afghán descent of the posterity of the 2nd son Batan is more than doubtful. It appears that Bíbí Máto (or Mátu) the daughter of Batan formed an illicit connection with Sháh Husein, (or Hússén, called also Mast'ali) a Persian Prince of Ghór and was made to marry him. The offspring resulting was named Ghalzai that is "the child of theft." She, however, also bore him a son Ibráhim Lódi from whom the former Pathán rulers of Delhi sprung. This Sháh Hussein was also by a fraud induced to marry Bíbí Máhi (or Mihi) daughter of the Kách or bard who managed his marriage with Bíbí Máto, and from her are descended the present Kághzai, Bangash and Sarwáni Patháns,

these the Duránis, Tarins and Kákars are Afgháns proper and so probably are the Lúnis, but the Zarkháns are merely known as Patháns.

First then regarding the Duránis, the chief of the Afghán clans. The origin of this tribe is apparently unknown, but it seems to be generally believed that it emigrated from the mountains of Ghór. According to the TAZKIRA'T-UL-MULU'K above quoted, the Duráni descent is as follows:





Annad Sháh Andáli and afterwards Duráni. The old name of

The old name of the Duránis was Abdáli, till Ahmad Sháh, an Abdáli of the Sadozai family or subsection of the Pópalzai section of Abdális, the hero of Pánipat, in 1747 took the title of Durri-I-Durra'n, the Pearl of Pearls, and named his tribe after himself Duránis. The two great divisions of the Duránis are Zi'rak and Panjpa'o, and of these the most honorable by descent are the Zi'raks. The Zi'raks are usually divided into 4 sections (1)

Those marked with an asterisk with the addition of Zai are the names of present Durini sections or subsections.

POPALZAI, (2) ALAKO'ZAI, (3) BA'BAKZAI, (4) ACHAKZAI and the PANJ-PA'OS into 5 sections, thus, (5) NU'RZAI, (6) KLI'ZAI, (7) ISHA'KZAI, (8) KHU'GIA'NI, (9) MA'KU'.* Along our present route, however, only the Achakzais were also found in any numbers, but a few of the Pópalzais and Bárakzais were also found in the Pishin. As far as I know there is but one Pópalzai village and one Bárakzai village in Pishin, but there are a good many Bárakzais scattered about the valley formerly concerned with the late government there. The Pópalzais of the valley are of the Sadozai subsection.†

The Ba'rakzais met with in the Pishin are all Muhammadzais,‡ connected in some way with the late government of the valley. Sirdár Khu'shdil Kha'n of the royal house seems to have been Governor of the

- There is also a low class of Duránis called Ságzai found in the Arghisán valley.
- † The Sadozais were the old ruling family of the Pépalzais and under Asad-ullah (of the Tribe Abdáll, sec. Pépalzai, subsec. Sadozai) threw off the yoke of the Persian at Herát in 1716, soon after Mír Vais, the Ghilzai, began to assert the independence of the Afghán nation. On the assassination of Nádir Sháh in 1747, Ahmad Khán, a Sadozai (afterwards Ahmad Sháh Duráni) gradually conquered for himself all Afghánistán and most of the Panjáb, and at his death in 1773 he was ruling from the Sutlaj to the Oxus and from the Himalayas to Khorásán. Till 1793 Taimu'r Sha'h his son reigned, but at his death his kingdom was fought for among his children in the way so common in oriental history, mainly resulting in the loss of the Panjáb to the Sikhs. The brothers who were ruling at the time of Taimu'r Sha'r's death were

ZAMA'N SHA'H in Kábul. HAMA'UN SHA'H in Kandahár. MAHMU'D SHA'H in Herát. ABBA'S MÍRZA' in Pesháwur. Ko'HANDIL MÍRZA' in Kashmír.

Of these Zamán Sháh and Mahmód Sháh obtained the throne of Afghánistán with the usual bloodshed, and after them another brother, the famous Sháh Shújah-ul-Mulk, about 1809. Mahmúd Sháh, however, ousted him and again ruled till 1818, when he was deposed by the Ba'hakzai brothers, sons of Paind Khán, his Wazír, and son of Hájí Jamál Khán (a Muhammadzai Bárakzai), the Sirdár who had helped Ahmad Sháh in the early days of his sovereignty. Since that date the Mohammadzai Bárakzais have fought among themselves for the throne resulting in the victory and sovereignty successively of the Amirs Dost Mohammad Khán, Shér Ali Khán and YaSúb Khán the late ruler. In 1839 the first Afghán war, the history of which is of course still fresh in our memories, was undertaken to restore Sháh Shújah-ul-mulk, the Sadozai, to his throne at Kábul. The Sadozais are still highly respected, and the Pópalzais from which they sprung are the most honoured among Afghán Tribes. During the greater part of the Sadozai ascendancy, the ministers were chosen from the Báme'zai subsection of the Pópalzais. The chief other subsections of the Pópalzais as far as I could ascertain are (3) Marsingzais, (4) Kha'nzais, (5) Aiyúbzais, (6) Madozais, (7) No'azais.

‡ The other subsection of the Bárakzais as far as I could ascertain were (2) ACHALZAIS, (3) SULIMÁNZAIS, (4) KHUNSEI'ZAIS, (5) BAIANZAIS.

Pishin under Shér Alí, but never to have lived there, and I was quite surprised to find how little appeared to be known about him locally. His fort, called Khúshdil Khán, is in the north-east corner of the Pishin, and from it his Naib or Lieutenant Nu'r Muhammad Kha'n (Muhammadzai Bárakzai) seems to have ruled and collected the revenues. This last fled at our advance into the Pishin in 1878, and the valley was handed over for government under Sir R. Sandeman, agent for Beluchistán, with the fort Khúshdil Khán, to another Nu'r Muhammad Kha'n, Luga'ri, a Belóch in our service as Názim or ruler.* This Khúshdil Khán's descent was given me locally, thus:

HAJI JAMAL KHAN (temp. Ahmad Shah Durani.)
| SIRDA'R PAIND KHA'N (Muhammadzai Barakzai)

MIHARDIL KHA'N.

PU'BDIL KHA'N.

Amír of Kábul.

KHU'SHDIL KHA'N.

Governor of Governor of KanPishin, 1878.

Governor of KanAmír of Kábul.

YARU'S KHA'N,
Amír of Kábul.

- Another and perhaps the most true local story is that Khúshdil Khán died about 7 years ago, say 1872, and in former days Abd-ul-Karím Khán (Muhammadzai, Bárakzai) was his Naib, but on Shér 'Alí's final accession in 1869, Khúshdil Khán lost his government and went to reside in Kandahár, while Nu'r Muhammad Kha'n (Muhammadzai Bárakzai) was sent to govern the Pishin direct from Sher 'Alí himself.
 - † Paind Khán's sons by 5 mothers were— (FATEH KHA'N Wazir of Mahmúd Sháh, 1. (MCHAMMAD KZIM KHA'N,
 - Taimu'r Kha'n.

Pu'rdil Kha'n, Governor of Kandahár, Sherdil Kha'n, Governor of Kandahár,

- 2. Kohandil Kha'n, Governor of Kandahár, Rahimdil Kha'n, Mihardil Kha'n.
 - (Do'st MUHAMMAD KHA'N, Amir of Kabul,
- 8. Ami'r Muhammad Khán, Jamál Khán.
 - Sultán Muhammad Khán,
- 4. YAR MUHAMMAD KHAN, PIE MUHAMMAD KHAN, SAYAD MUHAMMAD KHAN.
- 5. NAWÁB KOAD KHÁN, NAWÁB SAMA'T KHA'N, NAWÁB JAHAR KHÁN.

The ACHAKZAI section of the Duránis is the tribe inhabiting the mountains known as the Khoja Amra'n Range, the Toba Plateau, and the Pishin and Kadanei valleys in part. They are said to have been divided off from the Bárakzais by Ahmad Sháh, as that tribe was getting too powerful, and I have met Patháns about Kandahár, who classed the Achakzai as a Bárakzai subdivision. The Achakzais are divided into Baha'durzais and Gajanzais.

BAHADURZAIS.

GHABEZAIS.	Shamuzais.	Ba'karzais.	
Ka'kozais.	Fa'mzais.	Ishda'nizais.	
	GAJANZAIS.		
Ahmadzais.	Hamzais.	Alozais.	
ASHEZAIS.	Malikzais.	Julizais.	
Bu'rhanzais.	La'lizais.	Mushkizais.	
Shamakzais.	MA'PIZAIS.	Ba'dazais.	
MA'LIZAIS.	Hu'senzais.	Shakarzais.	
Ka'milzais.	Sulima'nzais.	Usma'nzais.	
Adazais.	ABDULLAZAIS.		
ADBAKZAIS.	BA'ZAMZAIS.		

I, however, came across two subsections of Achakzais not here mentioned called Habi'szais* and Abdals in the Pishin. This name Abdal may perhaps only be the title of the malik or chief as the present Sirdár Mir Aslam Kha'n of the Achakzais is locally called Mír Aslam Khán Abdal or Abdáli, as also is Madat Kha'n, the head of an Achakzai village in the Pishin, called after him. All the inhabitants of the last village, however, are called Abdals.

The next clan we have to deal with are the Tarins. These are the second of the Afghán Tribes in point of importance and national estimation. Their legendary descent from Kais is clearly made out. Saraban, Kais's eldest son, had five sons of whom the second was Tarin. Tarin had three sons, Tór Tarin, Spin Tarin and Abdal, and from the two eldest are descended the modern Tarin Tribe. According to a legend Tarin's dark son was called Spin Tarin or Fair Tarin, and his fair son Tór Tarin or Dark Tarin. The Tór Tarins inhabit the Pishin valley and the Spin Tarins the country about Tal and Chotiáli. Lumsden subdivides this clan as follows:

Lumsden, however, makes out the Habr'szais to be Tor Tarins, but as far as
 I could ascertain, they are Achakzais.

TOR TARINS.

Batazais. Alízais. Habíbzais.
Haikalzais. Núrzais. Hamránzais.
Málizais. Kulázais. Karbelas.
Kadazais. Músizais. Sázais.

Khánizais. Abdurrahmánzais.

Khámzais.

SPIN TARINS.

SHÁDÍZAIS. LASBÁNIS, ADWÁNIS. MARPÁNIS.

This list agrees with that given me en route as far as the Spin Tarins are concerned, but as regards the Tor Tarins mine differs considerably. First I would remark that the Habíbzais are, as far as I could make out. Achakzais and not Tarins at all. Next as regards the Karbélas, who have been hitherto put down as Tarins somehow connected with the Pishin Sayads, I have ascertained the following particulars. The Karbélas inhabit a village of the same name near SAYAD PAIND in the Pishin and call themselves Sayads. They are, however, disowned by the Sayads and also by the Tarins, Kákars and Duránis. The local legend regarding their origin is this. In days gone by, a little child by name Karbéla, was travelling through the Pishin in a káfila. He lost his party and was seen running along the road, crying, by a kind-hearted SAYAD who took him in and nourished him, but declined to admit him into his family or sect. On growing up, he married a Tarin woman, and from him there sprang by Tarin intermarriages the present race of Karbélas, now said to be 600 strong in men. This is the Savad version of the story, the Tarin legend is the same except as regarding intermarriages with themselves. They say the mother of the original Karbélas came from no one knows where and disown the whole race. The probabilities are, they sprung from Patháns who had to take refuge in the Pishin from some other distant place. The KHÁNIZAIS are divided into Lúr Khánizais and Dab Khánizais according to my information. In the list of Tor Tarins which I collected, the following do not appear in Lumsden.*

Málikyárs Manzakais Kamálzais.

Márzais Háru'ns.

While his list contains the following which are not found in mine.

Kádazais Náozais Hawránzais.

Khámzais Abdurbahmánzais

There are a few trifling variations in some names regarding which see below on Language.

The probabilities are that a combined list would reach nearest the true statement of their subsections.*

Like the Tarins, after whom they rank, i. e., third on the list of clans, the Kákars claim direct descent from Kais. Firstly, Kais's third son was GURGHUSHT who had three sons Dani, Babi and Mandi. Of these Dani had four sons, Kákab, Nághab, Dádí and Pání. † Secondly Shírání the eldest son of Sharif-up-di'n, eldest son of Saraban Kais's eldest son, on account of family squabbles joined the Kákars and called himself a Gur-GHUSHTAI. Such is the common legend. The Kakars themselves vary it thus. Kais went to Mecca and there obtained the name of PRET KHAN (elsewhere Pihtán). His eldest son Sharíf-ud-din or Sarabán had five sons Shirani, Tarin, Myuni, Barechil and Umar-un-din. The mother of Shirani, who was a Kakar, finding that her husband intended making TARÍN, his second son, his heir, left his protection and returned to her own tribe. Her descendants have therefore been included among Patháns and with them the whole of the Kákars under one name. This subverts the other legends which make the Kákars claim descent through GURGHUSHT from KAIS.

The following clans claim relationship with or descent from the Kákars. The GAKARS of Kashmir along the Jhilam, the TAIMUNIS (EIMAKS) of GHOR, the FIROZKOHÍ HAZÁBAS (EIMAKS) of HERÁT, the KAYANIS of SEISTÁN, § and lastly the KÁKARS and GHILZAIS also consider themselves nearly related in blood. Taking into consideration the unquestionably mixed blood of the Ghilzais and their legendary relationship with the Kákars, as also that of such pure EIMAKS as the HAZÁRAS and TAIMUNÍS. the Kákar descent from Kais would seem to be doubtful.

- Among the tribes of Tarin descent are said to be the ZAIMUKHTS.
- + This would make the Pa'nı'zais separate from the Kákars, but they seem to be considered a section of them at the present day.
 - † Whence the Barb'chi' Pathans of Shora'wak.
 - & Usually called Belochis, but really descendants of SANDAR KRE'L Kákars.
- A pure EIMAK is perhaps, however, a misnomer. The origin of the race being quite obscure. By features they are Ta'Tars and by language Persians. They are divided into Taimu'ni's, Haza'ras, Taimu'ri's and Zu'ri's. It may help towards the solution of the Eimak origin to quote the following from Yule's Marco Polo, L. 94. "Contemporaneously with the Karaunahs (or Kara'winahs the celebrated robbers of mediæval Persia) we have frequent mention of predatory bands known as NIGU'DARIS who seem to be distinguished from the Karaunans, but had a like character for truculence. Their head-quarters were about Sijista'n, and Quatremère seems disposed to look upon them as a tribe indigenous in that quarter. Hammer says they were originally the troops of Prince Nigu'dar, grandson of Chagatai (Chagatai was the ruler and curse of Turkistán and a son of Chingiz and therefore brother to Okkodai and uncle to Mangku, Kublai and Hula'ku), and that they were a rabble of sorts, Mongola, Turkmans, Kurds, Shuls and what not. We hear of their revolts and disorders down to

The Kákar Territory extends from the Pishin valley to the Borai valley and from the Zhób valley to Quetta, the line of the Bolán Pass and the Marri (Belóch) country. They are divided into two main divisions, the Great Kákars (Lowe' Kákar) and the Lesser Kákars (Kuchnai Kákar). As regards the Great Kákars, the present writer had but little opportunity of learning much. They occupy the Zhób valley and apparently are divided into—

Khwaidádzais, Aktarzais, Mehtarzais, Mursiángzais, Awazais, Sargarais.

And probably also the JALAGAIS, MU'SA KHEL and KARÍZAIS belong to this division.

The Lesser Kákars are divided into Sulimán Khels; Amand Khels; Mentarzais; Pánízais; Bázais; Shamozais; Surgarais; Malagais; Isá khels; Sara'ngzais, of which Mulázais and Táráns are subsections; Zakhpels, subdivided into Amakais, Kanozais and Náozais; Dumars; Utmán Khels; and Sandar Khels, whose known subdivisions are Alízais, Shabozais, Mu'rs, Dargais, Wahárs and Tenizais.* The Kákars about Khunchagai near Mt. Kand, variously called the Sanatía and Simantha Kákars, are I believe the Amand Khel above mentioned. They were formerly, under the name of Targhánís, under Hájí Khán of infamous memory during the war of 1839, and his son Kámil Khán is now chief of the Amand Khel.

The next clan met with en route was the Lu'ni (properly Lonai) Khel, about whom very little is known. They are generally supposed to be Kákars by descent, but I should say from what I heard from the Lu'nis themselves and from the Kákars, this is not the case. They call themselves of Duráni descent, a claim which is allowed by their neighbours. The Hamzazais are the only known subdivision of this Tribe, but there are

1319, up to which date Mirkhond says that there had been 21 fights with them in 4 years. Again we hear of them in 1336 about Herát, whilst in Báber's time they turn up as Nukdaris fairly established as tribes in the mountainous tracts of Karnu'd and Gror to the west of Kábul, and coupled with the Hazáras who still survive both in name and character. Among them, says Báber, are some who speak the Mongol languages. The Hazáras are eminently Mongol in feature to this day, and it is very probably that they or some part of them are descendants of the Karaunahs or Nigu'-Baris or of both, and that the origination of the bands so called from the scum of the Mongol inundation is thus in a degree confirmed. It is worthy of notice that Ab-ul-Farl who mentions the Nukdaris among the nomad tribes of Kábul says, the Hazáras are the remains of the Chagataian army which Mangku Kha'n sent to the aid of Hula'ku under the command of Nigu'dar Oghza'n.

• The Esôts of the De'RAJA'T are sometimes called Kákars but this is doubtful.
KA'EI' KA'KARS are said to inhabit the SHA'L Valley (Quetta), but I did not see any there.

doubtless more, and I think it would be safe to include Sarágis amongst them. They inhabit a largish extent of country, for the most part considerably deserted, and used merely as grazing-ground. Their villages are mostly found in what is called the Lu'ni Valley to the south of the Bórai, i. e., between it and the Tal Valley. All the country from the Bórai Valley east of the Tal Valley as far as the Belóch Border and the Mu'sa Khel country belongs to them, except the small portion occupied by the Zarkha'ns near Chótiáli.

Of the ZARRHA'NS nothing more is known except that they are Patháns and not of Kákar, Tarin or Lúni extraction. They are to be found about the mountains to the east and south of Chótiáli, in the HANOKAI Pass and BA'LA' DHA'KA'. The MARRIS have nearly wiped them out as a race by continual raids. In Leech's time* there were three villages belonging to them near Chótiáli, viz., Dost Muhammad, Fazl Khan and Alí Khan, but I do not know if they still exist.

Perhaps the origin of the Lúnis and Zarkháns and even of some of the Kákars, especially the Sandar Khél, should be sought with that of the neighbouring Beloch Tribes, if one could only ascertain what that is. deed the KAYANIS of SEISTAN usually called Belochis, are Sandar Khél Kákars, and there is nothing repugnant in the history of the Beloch Tribes to the idea of some of them being of the same descent as their deadly enemies the Pathans. For the KAIHIRIS about CHATTAR and PULEJI in KACHI, now acknowledged to belong to the Beloch Tribes, are of unquestioned Pathán descent. + And, although the presence of many Belochi words in their dialects may be the result of propinquity, the similarity of face and figure of the LU'NIS, SANDAR KHELS and ZARKHA'NS to the neighbouring Beloch Tribes of BA'RKHO'M is quite remarkable, and they might well have a common origin with them, especially as the Belochis can hardly be called a nation, being rather an agglomerate of heterogeneous tribes. Thus the Braho'is are probably aboriginal, the Gurcha'nis a Sindian Tribe. the RINDS and LU'MRIS probably of Hindú (Rájpút) origin and the GA'DURS of Las of Arab descent, while the tribes of MAKRA'N are Arabs, Sikhs. Sindhis, Persians, Jats and what not.1

- Major Leech's journeys were made about 1839.
- + Hughes's Beluchistán.
- ‡ In connection with the probable Turkman or Mongol origin of the bulk of the Beloch Tribes, the words Tuman and Tumanda's are interesting. Tuman or Tomam was a Mongol division of the army, viz., 10,000, and hence in the Mongol dominions it came to mean 10,000 generally. Wassa's describing Kinsay (Kingsse' or Hangchau) states it had "70 Tomans of soldiers and 70 Tomans of Rayats." Marco Polo states its revenue in Tomans of gold and Friar Odoric in Tomans of Balish (paper money). Than or Tha is still used in Russia for 10,000. In Beluchistan Tuman means a camp and Tumanda's the commander of a camp and thence the chief of a tribe, but whether

While discussing the Pathán Tribes something should be remarked about the Sayads found in every part of Afghánistán* and in some numbers in the Pishin where they own several villages. Wherever they may happen to be, they are a sect apart from the surrounding inhabitants, are always respected and seem to be more intelligent than the Patháns in general. They are not considered Patháns and claim to be of Arab descent as their name implies. This claim, however, is I think of a slender description among the Sayads in the Pishin with whom we have now to do. Their sympathies are all Afghán, they are subdivided in a suspiciously similar manner, and the story of their descent confirms the suspicions as to their separate origin from the Patháns about them. The story is that Ha'ru'n, fifth in descent from Kais, had a daughter who married an Arab Sayad who visited him, and from her are said to be descended all the Pishin Sayads, notably the Sha'dizais and Haidarzais.† The present subdivision of the Pishin Sayads appear to be—

GANGALZAIS. SHA'DÍZAIS. YA'SINGZAIS.
BAGARZAIS. BRAHAMZAIS. URUMZAIS.

Ajabzais. Haidarzais.‡

The following table shows the subdivisions of the tribes above discussed as far as known.

Tribe. No. Division. Subdivision, No. Subsection. I. Dura'nt or 1 ZÍRAK. 1 POPALZAI. 1 SADOZAI. ABDA'LI. 2 BA'ME'ZAI. 3 MARSINGZAI. 4 KHA'NZAI. 5 AIYU'BZAI. 6 MADOZAI. 7 NOAZAI. 2 ALAKO'ZAI. 1 JALUZAI. 2 MELAZAI. 8 SARKA'NI. 4 SANDARZAI. 5 KA'REZAI.

this is due to the passage of the Mongols through their country on towards Hindustán or to their Central Asian origin does not appear. Yule's Marco Pole, I, 94, 281 and II, 169, 171.—Hughes's Beluchistán.

* I saw one village of them in Barkho's among the Independent Belo'ch Tribes.

6 NAUSAZAI.

- † According to one legend, the KARB'ELAS are descended from a waif picked up by this HA'BU'N. See above.
- ‡ Among the Pishin Sayads faces of a Si'di' type are not uncommon, and I saw one woman with purely African features near A'Li'zai. This may result, however, from their wandering habits and be no indication of descent.

12 Ma'likai.
13 Ha'ru'n.
14 Kama'lzai.
15 Kadazai.
16 Kha'mezai.
17 Naozai.
18 AbdubrahMa'nzai.

II. Tarín. 2 Spi'n Tari'n. 20 Sha'dizai.
21 Marpa'ni.
22 Lasra'ni.
28 Adwa'ni.

No. Tribe. No. Division. No. Section. Subdivision. No. Subsection. III. KA'KAR. 1 Lowe' Ka'KAR 1 KHWAIDA'D-2 MURSIA'NGZAI. 3 AKTARZAI. 4 AWAZAT. 5 MEHTARZAI. 6 SURGARAI. 7 JALAGAI. 8 MU'SA KHEL 9 KABI'ZAI. 10 BA'BAKZAI. 1 TRAGARAL 2 KUCHNAI 11 SULIMA'N Ka'kab. KHEL. 12 AMAND KHELOT STMAN-THA OF SANATI'A. 13 MEHTABZAI. 14 Pa'nizai. 1 ADIZAI. 15 BAZAI. 16 SHAMOZAI. 17 SURGARAI. 18 MALAGAI. 19 I'sa' KHEL. 1 MULA'ZAL 20 SARA'NGZAI. 2 Ta'ra'n. 21 ZAKHPE'L. 1 AMARAL 2 KANOZAI. 8 NAOZAL 22 DUMAB. 23 UTMA'N KHEL. 1 A'LI'ZAI. 24 SANDAR KHEL. 2 SHABOZAL 8 Múr.

> 4 DARGAI. 5 WAHA'R. 6 TENIZAL. 7 KAYANL

IV. Lu'ni Khel. 1 Hamzazal. 2 Sara'61.

V. ZARKHA'N.

Tribes of doubtful Afghan descent.

	-	
I. SAYAD.	1	GANGALZAI.
	2	BAGARZAI.
	3	AJABZAI.
	4	SHA'DIZAI.
	5	Brahamzai.
	6	HAIDARZAI.
	7	YA'SINGZAI.
	8	Urumzai.
II. Karbela.		•

(To be continued).

On the Súryapraj napti.—By Dr. G. Thibaut, Principal, Benares College. Part I.

Until recent times our knowledge of the cosmological and astronomical system of the Jainas was very limited and founded not on an independent investigation of the original Jaina literature, but only on the occasional references made to Jaina doctrines by the orthodox Hindu writers on astronomy. For a long time the short account of the subject given by Colebrooke in his "Observations on the sect of the Jainas" (Asiatic Researches, 1807; Essays, Vol. II), remained the only one, and although accurate as far as it goes, it is very insufficient since it chiefly refers to the one doctrine of the Jainas only, which has at all times struck outsiders as peculiarly strange and absurd, viz., the assertion that there exist two suns. two moons and a double set of constellations. This is indeed the doctrine by which the system of the Jainas could most easily be distinguished from similar old Indian systems, and it is consequently referred to and controverted with preference in the Siddhantas. The best known passage from the latter is the one quoted by Colebrooke from Bháskara's Siddhánta-Siromani. "The naked sectaries and the rest affirm that two suns, two moons and two sets of stars appear alternately; against them I allege this reasoning. How absurd is the notion which you have formed of duplicate suns, moons and stars, when you see the revolution of the polar fish."

This passage of Bháskara's is manifestly founded on a passage found in Brahmagupta's Sphuta-Siddhánta where we read in the so-called Dúsha-pádhyáya:

भानि चतुः पश्चामत् देै। द्वावकीदया जिनाक्तं यत्। भुवसन्स्यत्यावका भवति यते।ऽस्टा ततस्वद्यत्॥ "There are fifty-four nakshatras, two risings of the sun; this which has been taught by Jina is untrue, since the revolution of the polar fish takes place within one day."

And a passage to the same effect occurs in the 13th adhyáya of Varáha Mihira's Pañchasiddhántiká.

In 1868 Professor A. Weber, to whom we are indebted for our first acquaintance with so many works of Indian literature, published in the tenth volume of the "Indische Studien" a paper on the Súryaprajñapti, being apparently the most important astronomical book whose authority the Jainas acknowledge, and it then appeared that the doctrine of the existence of two suns, moons, etc. constitutes only one feature of a comprehensive system which on the whole is much less fantastical than might have been expected and which, fantastical or not, shows intimate relations to the astronomical and cosmological views which appear to have prevailed all over India before Greek science began to influence the East. Especially it appeared—as pointed out by Professor Weber—that the doctrine propounded in the Súryaprajñapti shows in many points an unmistakable resemblance with that contained in the Jvotisha-Vedánga the presumably oldest specimen of Indian astronomical literature, and it thus became manifest that the astronomical books of the Jainas do not only furnish information about the opinions held by a limited religious sect, but may, if rightly interrogated, yield valuable material for the general history of Indian ideas. The writer of the present paper has therefore thought it worth while to submit the Súrvaprajñapti to a renewed detailed investigation, whereby we should be enabled rightly to esteem its position in the astronomical literature of India, clearly to conceive the peculiar features distinguishing the astronomical system of the Jainas from other systems, and on the other hand to point out what the Jaina system has in common with other systems, and in what way therefore it may be employed for the elucidation of the Professor Weber's paper gives in the main only a short summary of the contents of each chapter of the Súrvaprajñapti, following the order of the chapters as found in the work itself and omitting none of them. This was of course the right plan to adopt in a paper giving the first account of a hitherto unknown book. In the present paper it has on the other hand been preferred to give a connected account of the chief doctrines only which are found in the Súryaprajñapti, to combine hints found in the various parts of the work wherever this appeared necessary for the sake of greater clearness, and again altogether to omit relatively unimportant It must be stated at the outset that this paper-like that of Professor Weber-is based more on Malayagiri's commentary on the Súryaprajñapti than on the text of the latter work itself; which apparently anomalous proceeding finds its explanation in the fact of the Manuscripts

of the Súryaprajñapti, commonly met with, containing the commentary only in extenso, while as a rule only the first words of the passages commented on are given. As it, however, appears that the commentary faithfully follows the text, and as on the other hand the latter, devoid of a commentary. would be hardly intelligible, the absence of a complete text of the Súrvaprajūapti is less inconvenient that might at first be assumed. At any rate we may obtain at present a sufficiently full and accurate knowledge of the contents of the book; and in works of the class to which it belongs the interest attaching to the form is a comparatively small one. stated, the present paper is by no means intended as an exhaustive review of the contents of the Súrvaprajñapti; it is rather meant as an introduction to a complete edition of the work itself which, on account of the various old materials it contains, well deserves to be published in extenso. introduction of this kind could not well be missed, even if we possessed a complete edition or translation of the book, as the reader of the text of the work or of a literal translation of the text would find it by no means an easy task unaided to reconstrue the leading features of the system.

The Súryaprajñapti is written in Jaina-prákrit, and divided into twenty books called prábhritas, some of these again into chapters, called prábhrita-prábhritas. The arrangement of the matter treated of is by no means systematical, and the text, still more the commentary are full of tedious reiterations. Malayagiri, the commentator, has done his work most conscientiously; too conscientiously, the reader afflicted by his extraordinary diffuseness often feels tempted to say. Especially he delights in illustrating the numerical rules given in the text by at least half a dozen examples, where one would have sufficed, dwelling with evident complacency on each step even of the simplest calculation. But his comments are very perspicuous and certainly deserve to be extracted, although not to be reproduced in extense.

Proceeding now to our proposed task, let us dispose at the outset of the distinctive doctrine of the Jainas according to which there are two different suns, two moons and two sets of constellations. When inquiring into the origin of this certainly peculiar notion, we are led to a very simple reason, an impartial consideration of which makes the Jaina system appear much less fantastical and arbitrary than we at first are inclined to think. This reason has already been pointed out by Colebrooke, Asiatic Researches, Vol. IX, p. 321, where he says "They (the Jainas) conceive the setting and rising of stars and planets to be caused by the Mountain Sumeru and suppose three times the period of a planet's appearance to be requisite for it to pass round Sumeru and return to the place where it emerges. Accordingly they allot two suns, as many moons, and an equal number of each planet, star and constellation to Jambudvípa; and imagine that these appear on alter-

nate days south and north of Meru." These words scarcely require anything added to be to them in the way of comment. The Jainas hold (as will be seen in detail further on) the old Indian idea of sun, moon and stars revolving round Mount Meru. To anybody holding this opinion, the question must have suggested itself "In what time is one such complete revolution performed?" The prevailing opinion, represented for instance by the Puranas, was that the whole revolution is performed in twenty-four hours, so that the sun describes during the time when it is day in Bharatavarsha the southern half of his circle, and during the time when it is night to the south of Mount Meru, and day in the countries north of it, the northern half. The Jainas, however, took a different view of the matter. To them it seems to have appeared more appropriate that as there are four directionssouth, west, north and east-the sun's circle should be divided into four quarters corresponding to the four directions, and that he should bring day in succession to the countries to the south, west, north and east of Meru But then, as it must be supposed that his passing through each of the four quarters occupies the same time, how can it come about that he again appears to rise to the Bharatavarsha after the lapse of a period only sufficient to advance his place by one quarter of the circle? Out of this difficulty the Jainas extricated themselves by simply assuming that the sun rising on a certain morning is not the same sun which had set on the preceding evening, but a second sun similar in every way to the first one. The whole circle is thus described by two suns separated from each other by half the circumference, each of which appears in the Bharatavarsha on alternate days. The same reasoning lead to the assumption of two moons and two sets of stars.

Great as appears to be the difference produced by this hypothesis between the system of the Jainas and the commonly received opinions, it practically is of very small importance and may—as will be done in the following—as a rule be left altogether out of account whenever we have to consider the motions of sun and moon. When for instance the sun having started from Aśvini has passed through the twenty-eight nakshatras, he enters, according to the generally received opinion, again into the same nakshatra Aśvini, according to the Jaina opinion into a second nakshatra called Asvini too; but as this second nakshatra has the same name, the same extent, and the same relative position as its namesake, as like the latter it is preceded by Revati and followed by Bharani, and as at the same time when the sun has entered into the second Aśvini, another sun the exact and indistinguishable counterpart of the former one has entered into the former Aśvini, it is clear that we may, when speaking of the motion of the heavenly bodies, save ourselves the trouble of continually referring to two suns, two moons and two sets of nakshatras and, remembering

that there are two of each kind, express ourselves as if there were only one. To proceed.

The astronomic-chronological period on which the system of the Súryaprajñapti is based, is the well-known quinquennial yuga or cycle with which we have long been acquainted from the Jyotisha Vedánga. The same cycle is described in the Garga Samhitá as we see from the extant fragments of the latter work, and we learn from Varáha Mihira's Pañchasiddhántiká that it likewise formed the fundamental doctrine of a Paitámaha Siddhánta which, according to Varáha Mihira's judgment, was one of the more important Siddhantas known at his It is alluded to and rejected in a few words by Brahmagupta in the dúshanádhyáva of the Sphuta Brahma-siddhánta. References to this cycle are met with in the early history of Buddhism. Whether the so-called Vedic literature is acquainted with a cycle of this nature is doubtful.* It will not be necessary to dwell in this place at length on the constitution of the yuga; it will suffice to state that it is based on the assumption of five sidereal revolutions of the sun being exactly equal in duration to sixty-seven periodical revolutions of the moon and to sixtytwo synodical months, while one complete revolution of the sun is supposed to be performed in three hundred and sixty-six days. That a cycle of this nature based as it is on an utterly wrong assumption could maintain itself for a considerable time as it manifestly has done is a matter for legitimate wonder, and does not find a parallel in the history of chronological systems among any other civilized nation. At the end of one yuga already the quantity of the error induced by the mistaken estimation of the length of the solar year amounts to nearly $5 \times \frac{3}{4} = 3\frac{3}{4}$ days, the accumulation of which quantity after the lapse of a few yugas could not escape the attention, we should think, of even the most careless observers. The matter would indeed lie altogether differently if a conjecture (or as it stands we might almost say, an assertion) of Colebrooke referring to this point had been verified. He-after having given an account of the manner in which the Jyotisha-Vedánga manages to maintain harmony between civil and lunar time—continues "and thus the cycle of five years consists of 1860 lunar days or 1830 nycthemera, subject to a further correction, for the excess of nearly four days above the true sidereal year: but the exact quantity of this correction and the method of making it, according to this calendar, have not yet been sufficiently investigated to be here stated." The fact is that of this correction which Colebrooke considered so indispensable, that he speaks of it as being actually found in the Vedánga, no

^{*} The question referred to in the text cannot be discussed here. The writer hopes shortly to find an occasion fully to treat it elsewhere.

traces are to be found either in the Vedánga itself or-and this is of great importance as the Vedánga is still partially unexplained—in the Súrvaprajnapti which illustrates the constitution of the quinquennial yuga in the most diffuse manner, but has nothing to say about a correction of the kind mentioned.—The subdivisions of the yuga are in the Súryaprajñapti described with great fulness; what is really essential admits, however, of being stated in a few words. Each solar year is divided into two ayanas of one hundred and eighty-three days each. Each avana in its turn comprises six solar months, each of which lasts 301 days. Two of these solar months constitute a solar season; the reckoning of the seasons starts, however, not from the beginning of the yuga, but the latter is made to mark the middle of a season, so that the rainy season which counts as the first begins a month before the beginning of the yuga. Again the yuga comprises five years of 360 days each, each year in its turn being divided into twelve months of 30 days each; in the Súrvaprajñapti this kind of year-commonly known as the savana year—is called the karma-year or ritu-year which latter name would more properly be given to the solar year. The six days by which this year is shorter than the solar year are called atiratras. Again the yuga comprises sixty-two synodical months, the first of whom begins with the moon being full in the first point of Abhijit. Each of these months is divided into a light and a dark half; each half comprises fifteen tithis or lunar days of equal duration. Sixty-two of these months being equal in duration to sixty-one karma-months of 30 days each, it follows that sixty-two tithis are equal to sixty-one natural days; in order therefore to maintain harmony between the numbers of the natural days and those of the tithis, a break in the counting of the tithis is made whenever two tithis terminate during one natural day, i.e., according to the Súryaprajñapti on the occurrence of each sixty-second tithi. The details of this process are not stated in the Súryaprajñapti, but there can be no doubt that mutatis mutandis it was managed as it has been managed in India ever since. To give an example, the sixtieth natural day, counting from the beginning of the yuga, during which the sixtieth tithi terminated was counted as panchadasí (fifteenth tithi), the next following day as pratipad (first day of the new lunar half month) and then the day after that not as dvitivá. second lunar day, but as tritiyá third lunar day, the second lunar day having already terminated together with the preceding sixty-first natural day. These sixty-two lunar months are divided among five lunar years, the first, second and fourth of which comprise twelve lunations each, while the third and fifth count thirteen each. The technical name of years of the latter kind is abhivardhita-samvatsara, the increased year. The method according to which the two thirteenth months are intercalated in the yuga is

not described in detail; it is however clear enough how it proceeded. The thirty-first lunation and again the sixty-second one were not counted, but formed together with the month immediately following a kind of double month taking its name from the second constituting member. Thus there is nominally no thirteenth month, and a proper name for the latter is therefore not required.

Again the yuga consists of sixty-seven periodical lunar months, the moon during it returning sixty-seven times to the place from which she had started at the beginning. No attempt is made in the Súryaprajñapti to group these months into years nor are they subdivided into days of equal duration; they are simply said to comprise $27\frac{2}{67}$ days each. They are, however, subdivided into two ayanas each, analogously to the division of the solar year into ayanas. This division is indeed legitimate enough as it is based on the alternate progress of the moon towards the north and south, about which details will be given later on. Less comprehensible is on the other hand the division of each periodical month into six lunar seasons, whose names answer to those of the solar seasons beginning with the rainy season; a division of this kind is of course utterly gratuitous and purposeless, and to us interesting only as a specimen of the Indian's excessive tendency to systematize.

If we now proceed to an examination of the account given in the Súryaprajñapti of the revolutions of sun and moon, we find at the outset that it differs from the statements made by Garga and in the Vedánga in one important point. According to the latter authorities (see Jyotisha-Vedánga, v. 6; this Journal for 1877, p. 415; Weber, Nakshatras II, pp. 28, 33), the yuga begins with the winter solstice, at the moment when it is newmoon, sun and moon being in conjunction in the beginning of the nakshatra Dhanishthá; according to the Súryaprajñapti the yuga begins with the summer solstice, at the moment when the moon is full in the beginning of Abhijit and the sun consequently stands in Pushya. The coincidence of the winter solstice with new moon marking, according to the Vedánga, the beginning of the yuga may of course actually have taken place at the time when the doctrine of the quinquennial yuga was first established and will have recurred later on from time to time; but it is evident that it could not regularly recur every fifth year. To this fact, however, as well as to the change which in consequence of the precession of the equinoxes gradually took place in the position of the sun at the time of the winter solstice, the eyes of the Hindus seem to have remained shut during a considerable period. Now it is curious to see that in this one point at least the author of the Súryaprajñapti who, on the whole, faithfully adheres to the old system and does not hesitate to take over the quinquennial yuga itself with all its glaring imperfections, considered himself entitled or obliged to deviate from the received tradition. For once the testimony of the eyes was placed above old authorities. In the first place, the winter solstice had so far receded from the beginning of Dhanishthá that the change could not be ignored; in the second place, it must have so happened that at the time of the author of the Súryaprajñapti no new moon took place together with the winter solstice, while—as we may presume—some full moon happened to coincide or nearly to coincide with some summer solstice. Accordingly the beginning of the yuga was changed. Faute de mieux the summer solstice coinciding with full moon was taken as the new starting-point, and the sun's place at the time was removed from the middle of Aśleshá which it had occupied in the old system to a point in Pushya. The moon's place at the time of the summer solstice, being separated from the sun's place by half the circumference, is then at the beginning of Abhijit; the latter point marks at the same time the sun's place at the time of the winter solstice.

The account given in the Súryaprajñapti of the position of the sun at the two solstices enables us to enter into a consideration of the approximate time at which either the work itself or some older work on which it may have been based was composed. The expression "approximate" is used on purpose as the general difficulties besetting an estimation of this kind referring to Indian astronomical works are well known, and as in our case special difficulties arise in addition to them. As will be seen later on, the Súrvaprajñapti throughout employs twenty-eight nakshatras of unequal extent, while the Vedánga as well as the bulk of the later astronomical literature make use of twenty-seven nakshatras of equal extent. The relation of these two systems to each other necessitates a short excursus, for the starting-point of which we take a passage in Bháskara's Siddhánta Siromani (Grahaganita, Spashtádhikára, 71-74, p. 93 of Bápu Deva's edition) and a parallel passage from Brahmagupta's Sphuţa-siddhánta. The former of the two, translated, runs as follows:

"This method of finding the Nakshatras which has thus been taught in a rough manner by the astronomers for the purposes of common life, I shall now teach in an accurate form as it has been proclaimed by the rishis for the purpose of processions, marriages, etc. The experts have declared six (nakshatras) to have one portion and a half, viz., Viśákhá, Punarvasu and the (four) nakshatras called dhruva; six to have half a portion, viz., the constellations presided over by the Sarpas, Rudra, Váyu, Yama, Indra, Varuṇa; the remaining fifteen to have one portion each. The portion of one nakshatra is called the mean motion of the moon (during one ahorátra). The minutes of the circle lessened by the portions of all (the 27 mentioned) nakshatras are the portion of Abhijit, lying beyond the nakshatra of the Viśve Devas, etc." These statements are repeated in Bháskara's own

commentary, the Vásaná, where the common names of the nakshatras (Visákhá, Punarvasu, Rohiní, the three Uttaras; -- Asleshá, Ardrá, Svátí, Bharaní, Jyeshthá, Satabhishaj) are given and where Pulisa, Vasishtha, Garga and others are said to be the Rishis alluded to in the text. The rough mode of computation referred to in the beginning of the above quotation is the one contained in v. 67 of the same chapter and agrees with the rule given in the Súrya Siddhánta, II, 64. According to it, when we wish to find the place of sun or moon or one of the planets in the circle of the nakshatras, we have to divide the longitude of the heavenly body expressed in minutes by 800; the quotient then shows the number of nakshatras through which the planet has already passed, and the remainder the traversed part of the nakshatra in which it is at the time. This rule therefore bases on the assumption of twenty-seven nakshatras each of which extends over one twenty-seventh part of the circle. Now, according to Bháskara, the Rishis taught that whenever greater accuracy is required, the nakshatras have to be considered as being of unequal extent. In the first place only fifteen of them are to be regarded as having the average extent, while six exceed that amount by one half and six others remain below it by one half; and in the second place the twenty-seven nakshatras are no longer to occupy the whole circle, but only that part of it which corresponds to twenty-seven times the mean daily motion of the moon, while the remaining part of the circle is assigned to a twenty-eighth nakshatra Abhijit. Bháskara's statements are manifestly founded on a passage met with in the 14th chapter of the Sphuta Brahmasiddhanta which gives the same details regarding the different extent of the nakshatras, and is introduced by the following verse-

पासिक्ररामकवासिक्षसीरपीतामसेष यस्त्राक्षम् । तक्षसमामयमं मार्थभटोक्तं तदुक्तिरतः॥

"The calculation of the nakshatras, which has been taught in the Pauliśa, Romaka, Vásishtha, Saura, Paitámaha Siddhántas, is not mentioned by Aryabhata; I therefore proceed to explain it."

And later on-

षध्यभादिचेनावि संदितासभिद्यितानि गर्भायैः। यसाद् बद्धनि तसाद्वार्थभटे ात्रं तदानयनम्॥

The explicit statement about number and extent of the nakshatras in the older period of Indian astronomy, which is contained in the two passages quoted from Brahmagupta and Bháskara, is of considerable interest. If the account given by these two writers is correct and there is no reason to doubt of that, it appears in the first place that the mere circumstance of only twenty-seven nakshatras being mentioned in some detached fragment of an astronomical work which we do not possess in its entirety,

would not justify the conclusion of the author of the work having been acquainted with twenty-seven nakshatras only. Nay, even the author of a treatise like the Vedánga who throughout speaks of 27 nakshatras only may have done this simply because he meant his work to be an elementary one, unencumbered by the assumption of 28 nakshatras of unequal extent. In the second place the distinct statement that the old writers on astronomy made use of Abhijit solely when greater accuracy was aimed at, and that they then made its extent to correspond to the excess of a sidereal month above twenty-seven days, certainly seems to point to the conclusion that the introduction of Abhijit into the circle of the nakshatras was an afterthought, consequent on the improved knowledge of the length of the moon's periodical revolution. With regard to the books in which, according to Bháskara and Brahmagupta, the division of the sphere into 28 nakshatras of unequal extent was taught in addition to the simpler division into 27 equal nakshatras, we have to remark that the Súrya-siddhánta known to us contains no such statement; the Saura-siddhanta of Brahmagupta may have been a different work. We are unable to control the statement with regard to the Romaka, Pauliśa, Vásishtha-Siddhántas. Of Garga, however, we know from quotations several passages bearing on the point in question: in the first place, the passage quoted by Bhattotpala (in his commentary an Varáha Mihira's Brihatsamhitá, IV, 7; see Weber, Nakshatras, I. p. 309), which corroborates Bháskara's statement regarding the different extent of the Nakshatras, is, however, silent about Abhijit. As the passage stands, it would lead us to infer that Garga divided the whole circle into twenty-seven parts, the extent of fifteen of which is equal to one, of six to one half and of six to one and a half. The quotation may, however, be incomplete, and at any rate we have Brahmagupta's and Bháskara's word for Abhijit having been acknowledged by Garga too. However this may be, that Garga, as a rule, introduced into his calculations neither Abhijit nor the inequality of the extent of the twenty-seven nakshatras, appears from the places which he assigns to the sun at the two solstices, viz., at the beginning of Dhanishthá and the middle of Asleshá; for if we calculate the place of the summer solstice by starting from the beginning of Dhanishthá and making use of the unequal extent of the nakshatras, we obtain as place of the summer solstice not the middle of Asleshá but rather the end of it or the beginning of Maghá.

To return. The special difficulty by which we are met when attempting to compare the places assigned to the solstices in the Súryaprajñapti with the places which they occupy according to Garga and the Vedánga on one hand and the Siddhántas on the other hand, lies in the circumstance of our not knowing exactly how the two divisions of the sphere—the one into 27 nakshatras of equal extent, the other into 28 of unequal extent—were made

to correspond with each other. If we suppose—and this seems the most likely supposition—that each of the 27 nakshatras was curtailed by the twentyseventh part of the small portion assigned to Abhijit and that the reckoning started from the beginning of Abhijit, (which according to the system of the Súrvaprajñapti is the first of the series, as at the beginning of the yuga it is in conjunction with the moon), we may hazard an hypothesis with regard to the time lying between the Vedánga and the Súryaprajñapti, or rather between the observations of the solstices recorded in the two According to the Vedánga the winter solstice takes place in the beginning of Dhanishthá, according to the Súrvaprajñapti in the beginning of Abhijit (which is the place of the full moon on the day of the summer solstice at the beginning of the yuga, and consequently the place of the sun on the day of the winter solstice); the two places are therefore separated by the whole of Sravana and Abhijit. Having, according to the hypothesis stated above, reduced the extent of Sravana (=13.°33) by the 27th part of the extent of Abhijit, which extent is equal to about 4.º12, we obtain for Sravana 13.º18; to this we add Abhijit = 4.º12; the sum viz., 17.03 indicates the extent of the displacement of the solstice during the intervening period. Allowing seventy-two years for 1° of precession, the length of this period would be about 1246 years. If we therefore knew the absolute date of the Vedánga we might state the approximate absolute date of the observation recorded in the Súryaprajñapti, on the supposition always of the manner in which the two divisions of the sphere have been adjusted to each other being the right one. But, as Professor Whitney has shown, it is scarcely possible to form any satisfactory conclusion with regard to the date of the Vedánga, and we therefore abstain from giving a positive opinion about the date of the Súryaprajñapti.

We now proceed to a detailed consideration of the hypothesis by which the author of the Súryaprajñapti tries to account for the appearances presented by the various motions of the heavenly bodies, beginning with the

The three different motions of the sun which he endeavours to explain are firstly, the daily motion in consequence of which the sun seems to approach us from the East, passes through our field of vision and finally disappears in the West; secondly, the annual motion in consequence of which the sun seems to pass in the course of a year through the circle of the nakshatras, proceeding from the West towards the East; and thirdly the motion in declension according to which the sun ascends towards the north during one half of the year and descends towards the south during the other half. As in all systems which consider the daily motion of the sun to be real (not an appearance produced by the revolution of the earth

round its axis), the annual motion of the sun through the circle of the nakshatras is said to be apparent only, and produced by the circumstance of the motion of the sun being somewhat slower than that of the nakshatras, so that he daily lags behind by a certain quantity which accumulated during a whole year amounts to an entire revolution. How the Súryaprajñapti supposes the first and third motions to take place will appear from the following.

It must be remembered at the outset that the general conception of the configuration of the world which we find in the Súryaprajñapti is the same as that known from the Puránas. The earth is considered to be an immense circular flat consisting of a number of concentric rings, called dvípas, separated from each other by ring-shaped oceans. In the centre of the earth stands Mount Meru; around it runs the first dvípa—Jambudvípa, the only one which will concern us in the following. It is surrounded by a circular ocean, the water of which is salt (the lavana-samudra). The southern segment of the Jambudvípa is occupied by the Bháratavarsha, the northern segment by the Airávata-varsha; east and west of Mount Meru are the two portions of the Videha-varsha. Sun, moon and stars revolve round Mount Meru, in circles of different height above the Jambudvípa, the same heavenly body, however, always keeping the same height. The detailed features of these motions are now according to the Súrya-prajñapti as follows.

The circumstance of the sun seeming during one half of the year to approach daily more and more the north, while during the other half he seems to descend towards the south is explained in the following manner. On the longest day of the year which at the beginning of the cycle coincides with the first day of the lunar month S'rávana, the sun describes round the mountain Meru a circle, the diameter of which is 99,640 yojanas. The distance of the sun from the centre of Meru amounts therefore to 49,820 voianas. On the next day the sun describes a circle concentric with the first, and having a diameter greater by 5 35 yojánas, so that the distance of the sun, from Mount Meru now amounts to 49,820 + 2 45 yojanas. the same manner the diameter of the circle described by the sun increases by 5 35 on the third day, fourth day, etc., up to the day of the winter solstice, which according to the system is the 183rd day after the summer solstice. On this day the sun describes round Mount Meru a circle, the diameter of which is equal to 100,660 yojanas, so that his distance from Mount Meru amounts to 50,330 yojanas. Beginning from this day the solar circles contract again, by the same quantity daily by which they had expanded during the southern progress of the sun. During the 182 days intervening between the day of the winter solstice and the day of the following summer solstice the sun describes again the same 182 circles in

which he had descended towards the south, only in reverse order, until, on the day of the second summer solstice, he has again reached the innermost circle, from which he had started a year ago. During the second year the same expanding and contracting of the solar circles repeats itself and so on. The fact of the sun seeming to ascend towards the north during one half of the year, while he seems to descend towards the south during the other half is therefore explained by the supposition that he approaches us during the former half, while he recedes from us during the latter half. system does not assume that he actually ascends or descends; for all the circles described by him are at an equal height above the Jambudvípa; he only appears to us to stand lower at the winter solstice than he does at the summer solstice, because at the former period he has receded from us to the amount of five hundred and fifty yojanas. The exact localities too above which the sun describes his daily circles are defined. The innermost circle, i.e., the circle nearest to Mount Meru, which the sun describes on the longest day, would, when projected upon the earth, be distant 180 yojanas from the outer margin of the Jambudvípa. The second circle approaches nearer to that margin, the third still nearer, and so on, until the circles of the sun are no longer above the Jambudvípa itself but above the salt ocean, the lavanoda, which surrounds the Jambudvipa. Finally on the shortest day of the year the sun describes a circle which, in projection, is distant 330 yojanas from the edge of the Jambudvípa. After that he again approaches the Jambudvípa, and on the next summer solstice he has again entered into it to the amount of 180 yojanas. The technical term by which this recurring progress of the sun towards the Jambudvipa and the salt ocean is denoted in the Súryaprajñápti, is जगादर or जनगहति (-ते): the sun is said to merge himself, or to enter to a certain distance into the Jambudvípa or into the salt ocean accordingly as his circles are vertically above the land or the surrounding sea.

In connexion with the sun's motion in circles of different diameter, the Súryaprajñapti treats of the increase and decrease of the length of the day. As in the Jyotisha-Vedánga, the length of the day of the summer solstice is estimated at eighteen muhúrtas, that of the shortest day at twelve muhúrtas. The days between the two solstices are erroneously supposed to decrease or increase by a uniform quantity, which is easily found to be equal to $\frac{1}{180} = \frac{1}{100}$ of a muhúrta.

A number of opinions of other teachers agreeing with the theory stated above in its general features, but differing in the figures, are likewise given by the Súryaprajñapti.

Different opinions regarding the extent of the solar circles are given in I, 8 and, which comes to the same, different opinions about the distance of the two suns from each other in I, 4. According to this chapter there

were six different opinions about the distance of the two suns from each other on the longest day when the sun-or the two suns-describe the innermost and smallest circle. According to some teachers, the distance of the two from each other, or in other words the diameter of the circle they describe amounts to 1,133 yojanas, according to others to 1,134 yojanas: according to others again to 1,135 yojanas. Most probably we have to combine with these statements the statements given in the next chapter (I. 5) regarding the different opinions prevailing on the extent to which the sun "immerges" himself into the Jambudvipa and into the salt ocean. There we read that, according to one opinion the sun moves on the longest day in a circle which projected on the Jambudvípa is distant 1.133 vojanas from the edge of the latter, while on the shortest day he describes a circle above the salt ocean at the distance of 1,133 vojanas from the Jambudvípa. According to the opinions of two other sets of teachers, the number of vojanas in both cases is 1.134 and 1.135. If we combine these measures with the measures of the diameter of the innermost solar circle given above (and the sameness of the figures seems to entitle us to do so, although this is by no means explicitly stated). we get for the diameter of the whole Jambudvipa 1,133 (= diameter of the innermost circle) + 2 × 1,133 (= distance of the innermost circle from the edge of the Jambudvípa on both sides), therefore altogether 3,399 vojanas; or, starting from the numbers 1,134 and 1,135, 3,402 or 3,405 voianas. These are very moderate dimensions compared with the 100,000 vojanas, which length the author of the Súryaprajñapti himself attributes to the diameter of the Jambudvípa, and we shall not be mistaken in ascribing to opinions of this nature a considerably greater antiquity than to those represented by the Súrvaprajñapti. Besides, there is another circumstance in favour of such a view. The Súryaprajñapti throughout makes use of the relation $\sqrt{10}$: 1 for calculating the circumference of a circle. Thus for instance the diameter of the Jambudvipa being 100,000 (vojanas), its circumference is said to amount to 316,227 yojanas 3 gavy. 128 dhan. 131 ang. But those teachers who stated the diameter of the innermost solar circle to amount to 1,133 or 1,134 or 1,135 yojanas stated at the same time that its circumference amounts to 3,399 or 3,402 or 8,405 vojanas, i. e., they made use of the relation 3: 1 for calculating the circumference of a circle from its diameter. The adoption of this very rough approximate value seems to point back to a comparatively ancient time.*

[•] It seems that all Jaina books take 1: $\sqrt{10}$ as expressing the relation of the diameter to the circumference. See for instance Bhagavatí Sútra II, 1. 45 (Weber, p. 264), where, however, some confusion seems to have crept into the figures. The old and simple relation 1: 3 is found for instance in the Bhúmiparvan contained in the Bhíshmaparvan of the Mahábhárata. There the circumferences of the planets are

Three more opinions concerning the distance of the two suns from each other on the longest day are quoted. According to the first, one whole dvips with the addition of the surrounding ocean intervenes between the two; according to the second two dvipss and two oceans; according to the third three dvipss and three oceans. The distance in yojanas is not given. Two more opinions concerning the extent to which the sun enters into the Jambudvipa are stated; according to some the sun enters on the longest day into half the Jambudvipa and on the shortest day into half the salt ocean; the distances in yojanas are not mentioned. And according to others the sun enters neither into the Jambudvipa nor into the salt ocean, but moves in the interval (apántarála) of the two; how we have to imagine this interval does not appear.

The eighth chapter of the first book contains a long exposition of the dimensions of the circles described by the sun. Four different dimensions are stated. Instead of simply giving the length of the diameter, the length and breadth (áyáma and vishkambha) are given; these two are of course equal in a circle. Then the circumference of the circle is given, according to the ratio $\sqrt{10}$: 1, and finally the "váhalya," the thickness of the circle, i. e., the diameter of the space filled by the mass of the sun or more simply the diameter of the sun himself. This amounts according to the Súryaprajñapti to 45 of a yojana. diameter and the circumference of the circles are of course continually changing, the circle described on the longest day having the smallest dimensions and that described on the shortest day having the greatest. The dimensions of the small circle and the amount of the daily increase have been mentioned above; it is therefore not necessary to follow the Commentator into the very tedious calculation of the dimension of each daily circle. The opinions of three other teachers on the dimensions of the circles, according to which the diameter amounts to 1,133 yojanas etc., have already been mentioned; the thickness of the circle, i. e., the diameter of the sun is held by them to amount to one yojana.

We turn now to the statements regarding the velocity with which the sun moves in his different circles, and among these at first to those made by the Súryaprajñapti itself. The calculation is a very simple one. Each daily circle being described by two suns, each of which travels through half of it in thirty muhúrtas, the whole circle is described by one sun in sixty muhúrtas, and consequently we have, in order to find the velocity of the sun, to divide the periphery of the daily circle by sixty; the quotient is the number of yojanas travelled through by the sun in one muhúrta. Thus the sun, when travelling in the smallest innermost circle, the circumference

stated in numbers which are the threefold of the numbers expressing the diameters : चन्द्रशास सच्चादि राजनेकाद्य स्थाः । विद्यासेन क्रुप्त प्रसास स्थान स्थान स्थान

of which is 315,089 yojanas long, passes in one muhurta through 5,251 32 yojanas. On the following day both suns travel in the second circle which is somewhat larger than the first one, and consequently the suns having to describe a larger space in the same time, i. e., during the duration of a nycthemeron travel somewhat faster, pass in one muhurta through 5,251 47 yojanas. Thus day after day the speed of the two suns is increasing in accordance with the continually increasing extent of the diurnal circles, until on the day of the winter solstice both suns travelling in the outmost circle pass through 5,305 10 yojanas in one muhurta. Beginning from this day their speed diminishes as they are again approaching the innermost circle, until on the day of the next summer solstice their rate of speed is again at its minimum. In connexion with this discussion of the swiftness of the sun, the Súrvaprajñapti treats of the question of the distance from which the light of the sun becomes visible to the inhabitants of the Bharata-varsha. By this distance we have, however, to understand not the distance of the sun from the Bharata-varsha in a straight line, but rather that part of the sun's daily circle which lies between the point of the sun's rising and the meridian. It is well known, says the Commentator, that the sun becomes visible to the eye of man at a distance equal to half of the extent (kshetra) over which he travels during the whole day, i. e., at the time of his rising, his distance from us (=from our meridian, although this is not expressly stated in the Súrvaprajñapti) is half of the arc which he describes during the whole day. The length of this arc has to be measured simply by the time which the sun takes to travel through it. Thus, for instance, on the longest day the sun is visible to the inhabitants of the Bharata-varsha during eighteen muhurtas out of thirty; from the moment of his rising he will therefore take nine muhurtas to come up to the point straight in front of us (to the meridian). Now we have seen before that on the longest day the sun travels over 5,251 39 yojanas in one muhurta; consequently he travels in nine muhurtas over 47,263 31 vojanas. This therefore is the distance—expressed as an arc of the diurnal circle -at which he becomes visible to the eye of man. On the shortest day on the other hand the sun is visible for twelve muhurtas only; we have therefore to multiply the amount of his motion in one muhurta by six in order to find the distance at which he first appears to the eye of man on that day.

Regarding the swiftness of the sun four other opinions are recorded by the author of the Súryaprajñapti. According to some teachers, the sun travels in one muhúrta over six thousand yojanas, and as far as it appears this rate of motion is the same in whatever circle the sun is moving. How these teachers accounted for the fact of the sun taking the same time to travel through a large circle as through a small one is not explained. The amount of space illuminated on each day (the tápakshetra), expressed as are of the diurnal circle of the sun, they calculated in the same manner as the author of the Súryaprajñapti, viz., by multiplying the amount of motion in one muhúrta by the number of the muhúrtas of the day. Thus the tápakshetra on the longest day would amount to 108,000 yojanas, that on the shortest day to 72,000 yojanas. According to the opinions of two other schools, the motion of the sun in one muhúrta amounts to 5,000 yojanas or 4,000 yojanas. Here too nothing is said about any variation in the sun's speed at different times of the year. The tápakshetra is calculated in the manner stated above. The last opinion mentioned is that of some teachers who held the rate of speed of the sun to be different during different periods of the day. According to them, the sun passes over six thousand yojanas in the muhúrta after his rising and in the muhúrta preceding his setting, over four thousand yojanas during the muhúrta in the middle of the day and over five thousand yojanas in all other muhúrtas.

The various opinions prevailing with regard to the rising and setting of the sun are detailed in the first chapter of the second book. The opinion of the author clearly appears from what has already been stated. no real suprise or sunset; the sun or rather the two suns revolving round Mount Meru appear to rise to the inhabitants of some particular place at the moment when they enter their field of vision, and they appear to set when they leave it. In reality they always move above the Jambudvípa at the same height, estimated by the Súryaprajñapti to amount to eight hundred yojanas. At the beginning of the yuga at sunrise on the first of Srávana the Bhárata sun becomes visible to the Bhárata-varsha having reached the south-east point of his diurnal circle; diametrically opposite to it, viz., in the north-west point of the same circle the Airavata sun appears to rise to the inhabitants of the tracts north of Mount Meru. During the course of this day the Bharata sun therefore illuminates the countries to the south; the Airavata sun those to the north of Meru. At the time of sunset the Bhárata sun having passed through the southern segment of his circle disappears from the view of the people south of Meru and enters the view of those west of Meru; these latter therefore have their day while it is night in Bhárata-varsha. At the same time the Airávata sun appears to have set to the people north of Meru and to have risen to those east of Meru. On the second day the Bharata sun rises to the countries north of Meru and the Airávata sun to the Bhárata-varsha. On the third morning the Bhárata sun has completed a full circle and therefore again rises to the Bhárata-varsha while the Airávata sun again rises to the regions north of Meru. And so on ad infinitum. We may recall here a parallel passage from the Vishnupurána (II, 8), tending to illustrate how sunrise and sunset were conceived to take place on the hypothesis of the sun (the Puranas

know of one sun only) moving round Meru. "The sun is stationed at all times in the middle of the day (i. e., it is always midday at that place above which the sun is) and over against midnight in all dvipas. In the same manner rising and setting are at all times opposite to each other in all the cardinal and intermediate points. When the sun becomes visible to any people, to them he is said to rise, and wherever he disappears from the view there his setting is said to take place. Of the sun which is always (above the earth) there is neither setting nor rising; his appearance and disappearance are called his setting and rising."*

The Súrvaprajñapti adds an interesting account of other views regarding the sideway-motion (tirvag-gati) of the sun. According to some the sun is not a divinity, but only a mass of rays which in the morning form themselves in the East into a globular shape, pass sideways along this visible world, and in the evening dissolve again in the West. This process repeats itself daily. According to others the sun is the well-known divinity; but each morning he is born anew according to his nature in the ether in the East (svabhávád ákása utpadyate), passes along this world and dissolves (vidhvamsate) at evening in the ether in the West. According to others the sun is the mighty everlasting god known from the Puránas; in the morning he rises in the East, passes over this world, and at evening sets in the West; from thence he returns below to the East, illuminating the parts This—the commentator says—is the opinion of those who hold the earth to be a globe; it finds great favour at present among the tirthantarivas and is thoroughly to be studied in their Puránas. This opinion has three sub-divisions. Some say the sun returning at daybreak from the parts below rises in the ether (ákáse) and sets in the ether; others say he rises or originates (uttishthati utpadyate) in the morning on the summit of the mountain of rising (udaya-bhúdhara-śirasi) and perishes (? vidhvamsate) in the evening on the summit of the mountain of setting (astamayabhúdhara-śirasi); this repeats itself daily. (But, if he "utpadyate" and "vidhvamsate," how can he pass under the earth during the night?). Others say he rises in the morning on the mountain of rising and enters in the evening into the mountain of setting, illuminates during the night the subterraneous world and rises again from the mountain of rising. Others say, he rises, that is, originates from the eastern ocean in the morning, pe-

[•] Mr. Fitz-Edward Hall (Wilson's Vishņu Puráṇa, Vol. II, p. 242) directs our attention to the "heliocentricism" taught in this passage. But clearly there is no trace of heliocentricism to be found in it. He apparently is misled by the words अवेतः स्वः which he translates "of the sun which is always in one and the same place." But this translation is quite untenable, since the Vishņu Puráṇa most unambiguously teaches the sun's revolution round Mount Meru.

rishes at evening in the western ocean (same objection as above); others again, he rises from the eastern ocean, enters at evening into the western ocean, passes during the night through the subterraneous world, rises again from the eastern ocean. The last opinion mentioned is not very clear and an account of it is therefore not given in this place.

The third and fourth books contain particulars about the tapakshetra, i. e., that part of the Jambudvípa which on each day is illuminated by the sun or rather by the two suns. The shape of this tapakshetra the Survaprajnapti compares to that of a kalambuká-flower turned upwards, a comparison which has to be understood in the following manner. Each of the two suns illuminates a sector of the large circle formed by the Jambudvípa. These sectors are, however, not complete, but a piece is cut off from each by Mount Meru which standing in the middle of the circle repels by its own superior radiancy the rays proceeding from the two suns and therefore is not included in the tapakshetra. The interior border of the sectors is thus formed by a part of the circumference of Mount Meru, their outward border by a part of the circumference of the Jambudvipa. Between these two sectors of light there lie two sectors of shade (andhakara); whatever part of the Jambudvipa is covered by the two former enjoys day at the time while it is night in the regions covered by the dark sectors. As the two suns revolve these four sectors revolve with them, sweeping over the whole extent of the Jambudvipa and producing alternate day and night in The relative magnitudes of the tapakshetra during the differall its parts. ent parts of the year is estimated in accordance with the statements about the relative length of night and day. On the longest day the two suns. moving in the innermost circle, together illuminate three-fifths of the Jambudvipa, each of them three-tenths; on the shortest day they illuminate two-tenths each, together two-fifths. On the day after the summer solstice when the suns have entered into the second circle, and are moving at a greater distance from the centre, the extent of the tapakshetra decreases

accordingly, so that it then equals $\frac{3}{5} - \frac{1}{5 \times 183} = \frac{3}{5} - \frac{1}{915}$ of the whole Jambudvípa only; the same decrease repeats itself daily up to the day of the winter solstice when the extent of the illuminated portion of the Jambudvípa has reached the minimum stated above. From that period it again begins to increase by the same portion daily. From this the absolute dimensions of the tápakshetra or, to express it more conveniently, of one of the two sectors composing the tápakshetra are easily derived. The two straight lines by which it is limited are equal in length to the radius of the Jambudvípa less the radius of Mount Meru (50,000-5,000-45,000) yojanas). To this we find in one passage of the Súryaprajñapti added the sixth part of the breadth of the salt ocean surrounding the Jam-

budyipa, up to the end of which the light of the sun seems to reach, on the longest day at least; this gives altogether 78,3331 yojánas (= 45,000 + In the statements regarding the measure of the two arcs limiting the sector, no reference is made to the salt ocean. We find these measures for the longest day by dividing the circumference of Mount Meru as well as that of the Jambudvipa by ten; three of these ten parts of the first kind give the interior arc of the truncated sector, three of the second kind the exterior arc. On the shortest day we have to take twotenths instead of three, and there is no difficulty in finding the corresponding increase or decrease on all days between the summer and winter solstice. In the same manner the dimensions of the andhakara, the dark portion of the Jambudvípa, are readily ascertained. Finally some statements are made about the distances to which the light of the two suns reaches above, below and towards both sides. It is said to reach to a thousand yojanas above (above the chariot of the sun, svavimánád úrdhvam). Further it is said to reach down to the depth of 1,800 yojanas, for which the following explanation is given. The sun is at the height of 800 yojanas above the earth, and below the surface of the earth at the depth of 1,000 yojanas are the subterraneous regions (adholaukikagrámáh), down to which the sun's rays are penetrating. No further details about these subterraneous dwellings Towards both sides, the east and the west, the light of the sun is said to extend to the distance of 47,263 21 yojanas.

For the sake of completeness, the various other opinions with regard to the subjects treated in the last paragraphs are added. Some say that the sun and moon illuminate one dvípa and one ocean; while according to others the numbers of dvípas and oceans illuminated are 3, 3\frac{1}{1}, 7, 10, 12, 42, 72, 142, 172, 1042, 1072. No details are given. One chapter contains the enumeration of a number of very fanciful opinions about the form of the tápakshetra, which it would, however, be purposeless to extract in this place.

On the assumption that the sun describes every day a circle which is at the distance of 2 \frac{4.5}{6.1} yojanas from the circle described on the preceding day, the question naturally suggested itself, how the sun passes over from one circle into the next one. This question is treated in I, 6, and II, 2 where two different opinions are expounded which, although the account given of them is not altogether clear, appear to be of the following nature. According to some the sun enters from one circle into the other, "bhedaghátena" which (bheda being explained to signify apántarála) seems to mean that the sun passes from one circle into the next one by moving over the distance separating the two all at once. Thus the sun would really move in perfect circles and the motion across from one circle into the

other would be a momentary one only. The other opinion, and to this the Súryaprajñapti seems to adhere, is that the sun does not in reality move in separate perfect circles, but rather in an uninterrupted spiral line. As the Súryaprajñapti expresses it, the sun begins from the moment he has entered the first circle to move "śanaih śanaih" across towards the second circle, and as soon as he has reached the second circle, he begins to move towards the third circle, etc. The term "karna" which occurs in this description of the sun's motion seems to denote the spiral line which passing across the whole room between the two circles connects the two; a line which might properly enough be called "karna," i. e., diagonal. On this hypothesis then we should have to remember that the sun is only for convenience sake said to describe a separate circle on each day, and that in reality he is supposed to describe a continuous spiral line.

After having thus given a succinct account of the Súryaprajñapti's theory concerning the motion of the sun, we now proceed to consider the statements referring to the motion of the moon.

(To be continued.)

Memorandum on Clay Discs called "Spindle Whorls" and votive Seals found at Sankisa, Behar, and other Buddhist ruins in the North Western Provinces of India.—By H. RIVETT-CARNAC, Esq., C. S., C. I. E., F. S. A. (With three Plates.)

Last year I submitted for the inspection of the Asiatic Society specimens of stone and clay discs, similar to what are called "spindle whorls" by the Antiquaries of Europe, found by me at the Buddhist ruins of Sankisa, Behar, &c. in the Fatehgarh District, N. W. Provinces of India. Certain clay seals stamped with the Buddhist formula found in the same localities were also exhibited. The resemblance between these "spindle whorls" and those described and figured by Dr. Schliemann in his work "Troy and its Remains" was briefly noticed by me at the time. Since then I have obtained some more specimens of these discs and seals, and I think it well that they should be submitted for the inspection of the Asiatic Society, and that the attention of its Members and of other Antiquaries should be directed to the resemblance to be traced between these remains and those found in the ruins of Hissarlik and in many parts of Europe.

First as regards so called "spindle whorls." When we were encamped at Kanouj, Sankisa and Behar Khas in the Fategarh district, the village urchins were encouraged to bring to us everything in the shape of "Antiquities" that could be grubbed out from these extensive ruins and from neighbouring mounds. These sites, as is well known, present many features

of resemblance to those which Dr. Schliemann dug through at Hissarlik, described at length in his work upon Troy. That is to say, it is generally found in the case above-mentioned that the site has been selected on account of some Kunker Hill which, rising out of the flat alluvial soil of the Doab, offers a point of vantage for the building of a fort or city. Here, as at Hissarlik, these sites often bear the traces of several distinct colonies. The mud buildings of one set of colonists have been razed by their conquerors or successors to build thereon houses and temples which have again been levelled to form the foundations of the habitations of later settlers. The high mounds, on which part of the present town of Kanoui is perched, is to be accounted for in this way, and there can be little doubt that if shafts were to be carried through the ruins there, after the manner adopted by Dr. Schliemann at Hissarlik, the traces of several distinct periods might be unearthed. What has been said of Kanouj holds good in regard to Sankisa, Ramnuggur and other ruins. not yet been done to explore these localities, and the recent interesting find of Mitra coins, reported by me to the Society, indicates that careful investigation might prove remunerative to antiquarian research. The heavy rains of India are, however, of much assistance in running amateur sections through the ruins, and in exposing from time to time relics of more or less interest. Amongst these may be classed the "spindle whorls" now to be noticed, many of which together with coins, beads, etc. are collected and set aside by the villagers as possessing some mysterious significance, and are brought out for sale when the District Officer or some occasional visitor camps near the place.

Of these clay discs and their stone prototypes four distinct classes are to be noticed:

- A. Terra Cotta Discs, plain and ornamented.
- B. Ditto with a hole through the centre.
- C. Terra Cottas "in the form of a top and the crater of a volcano" (I use the words of Dr. Schliemann, Troy, p. 38 to describe these peculiar specimens).
 - D. Clay Balls, plain and ornamented.

With respect to A, Clay or Terra Cotta discs, these were brought to us in enormous quantities, and, if disposed to do so, we might have purchased and carried off several elephant loads of this description of relic. At the time I did not attach much importance to them, and am sorry now that no careful selection was made of those bearing different styles of ornamentation. They are all of red or black clay well baked. In size they vary from 1 inch to 2 inches in diameter and are about 1 of an inch in thickness. The majority of them bear a rough ornamentation at the edges only, see Plate XIII, sketches 1 and 2. Others again show traces of more elaborate design and workmanship. Some of these are figured in sketches 3 to 7.

On one, No. 5 of my sketch, will be seen the broad arrow noticeable on Schliemann's No. 458. On another, No. 6, is what looks like the sign of Saturn or what Dr. Schliemann calls the "mystic rose," well known on Buddhist coins and in Buddhist art. They all have more or less ornamentation at the edges, resembling the spokes of a wheel or possibly the rays of the sun.

I also obtained at Sankisa several stone discs of nearly the same shape as the Terra Cottas. They are all highly polished. One is of black marble, another of crystal. Several are of red marble, and the material must have been brought from a distance, as no stone save kunkur is to be found within many miles of Sankisa. It will be noticed that all these stone specimens are grooved at the edges, see the section in sketch No. 8, whereas but few of the clay specimens have received such treatment.

Type B, sketch No. 9, on Plate XIV consists of clay discs similar in most respects to the foregoing, save that a hole has been drilled through the centre of each. I did not pay any particular attention to the proportion in which these different classes were brought to me in camp. But I find that I have many more of the plain discs than of those which have been pierced. There can be little doubt, however, that many hundreds of the pierced ones might have been obtained on the spot, and I am sending to ascertain whether any more ornamented specimens are procurable. The specimen marked and figured in sketch No. 10 is of grey granite. It bears the same relation to the pierced clay discs as the stone and crystal discs mentioned above bear to the clay whorls of type A. In the centre is a hole, round which are six concentric circles.

The specimen figured in sketch No. 11, is of a somewhat different type from the foregoing, as a section of the sketch will explain. The impressions of the spokes of a wheel with dots between each spoke appear to have been made in a stamp or mould. I find I have only two of this class in my collection. But doubtless hundreds more might have been obtained had I not been afraid of burdening myself during the march with too large a collection of such specimens.

Of type C, Sketches Nos. 12 and 13, on Plate XIV, which may be described in Dr. Schliemann's words as being in the form of a "top or crater of a volcano" I have, I find, but 4 or 5 specimens; I have little doubt that large numbers were offered to me, but at the time they did not appear to possess any particular significance. It was only in tumbling out a large number of discs from the box, in which they had long been kept, that I recognised this type of the illustrations of Dr. Schliemann's book, just consulted with reference to the Discs A and B mentioned above. The specimens I have with me do not bear any marks of ornamentation. Further search may perhaps bring better specimens to light. (Since this was written some ornamented ones have been found.)

Lastly we have type D, Clay Balls, Plate XIV, sketches Nos. 14, 15, 16, resembling somewhat those figured by Dr. Schliemann. Several of them are roughly ornamented, and the designs, such as they are, will be seen from the sketches.

I hardly know how it happened that these specimens were carried away by me. Certainly no importance was attached to them at the time; and they would have escaped my notice altogether, had I not seen, when comparing the clay discs, the sketches of somewhat similar balls figured in the last pages of Dr. Schliemann's book.

Lastly, I have also figured two specimens Nos. 17 and 18 which seem to approach type C. And an enamelled glass bead No. 19.

This bead is similar to that figured in Thomas' Prinsep, Pl. IV, No. 13. These beads are found in large quantities together with crystal, onyx cornelian and others at Sankisa and similar ruins. It seems desirable to figure the specimen with this paper in order to ascertain whether similar ones are found in Europe or elsewhere. The village urchins during the rains make a practice of collecting these beads, and they are usually given to fakirs or devotees. Seeing such a necklace worn by an old fakir led me to enquire whence the beads came. And I had little difficulty in procuring a variety sufficient for about nine necklaces.

I have now to direct attention to the resemblance between the specimens above described and figured, and those discovered by Dr. Schliemann at Hissarlik and noticed at great length and figured in large numbers in his well known work upon Troy.

As regards type A, clay discs more or less ornamented, without the central hole, I cannot be quite certain that this type was found by Dr. Schliemann. I do not see that any distinct mention is made of unpierced discs, and it is not quite clear from the sketches in Dr. Schliemann's work, whether, what is referred to as the Central Sun on the Discs figured in plates 22 and 23, is a hole drilled through the centre or is a depression or ornamentation representing the sun. Still, even if this particular type was not found at Hissarlik, it is found in Italy, and, as will be shewn further on, the resemblance between the remains found at Hissarlik and those of Italy is referred to by Dr. Schliemann.

Dr. Schliemann writing of his discoveries at page 187 of his work above quoted, thus refers to the discs:

"During the last few days we have also found, in the strata next above the primary soil, at a depth of from 46 to 36 feet, a number of round brilliant black terra cottas of exquisite workmanship; most of them much flatter than those occurring in the higher strata and resembling a wheel; many are in the shape of large flat buttons. But we also meet with some in the form of tops and volcanoes which differ from those found in the higher strata only by the fineness of the terra cotta and by their better workmanship. The decorations on these very ancient articles are, however, generally much simpler than those met with above a depth of 10 meters (33 feet) and are mostly confined to the representation of the sun with its rays, or with stars between the latter, or of the sun in the centre of a simple cross, or in the middle of four or five double or treble rising suns. At a depth of 6 meters (20 feet) we again found a round Terra Cotta in the form of a volcano, upon which are engraved three antelopes in the circle round the sun.

"At a depth of from 5 to 8 meters (16\frac{1}{2}\) to 26 feet) a number of terra cotta balls were found, the surface of each being divided into eight fields; these contain a great many small suns and stars, either enclosed by circles or standing alone. Most of the balls, however, are without divisions and covered with stars; upon some I find the swastica and the tree of life, which, as already said, upon a terra cotta ball found at a depth of 26 feet, had stars between its branches." (Schliemann's Troy, p. 187.)

The above extract embraces not only the so-called spindle whorls, but mentions the volcano-shaped "whorls" of type C found at Sankisa and type D brought away by me from the same place. The discs were found by Dr. Schliemann of terra cotta, of marble and of crystal. So at Sankisa did we find clay, marble and crystal discs.

A comparison of the Plates appended to Dr. Schliemann's volume with the specimens submitted by me and the sketches which accompany this paper will, I think, shew that there is at least some resemblance between the remains found at Hissarlik and those at Sankisa.

On nearly all these discs will be seen what are constantly referred to as the spokes of the wheel or the rays of the sun. I have placed side by side with my sketches a copy of the whorl engraved by Dr. Schliemann at page 137. It might fairly be taken to be a representation of the whorl given in Plate XIV, Sketch 10 appended to this paper.

Then my collection is unfortunately in no way large or complete. When at Sankisa, I had little idea of the significance of these remains or their resemblance to well known types, and I only purchased a few of them in the manner that I collect everything that seems to be unusual or strange. Further search may possibly bring out even more remarkable points. The few specimens that I have succeeded in obtaining bear, however, a resemblance, not only in shape, but also in ornamentation, to those figured by Dr. Schliemann, sufficient to render the subject interesting. The broad arrow of my Sketch No. 5 and the Mystic Rose or sign of Saturn, or the numeral four of my Sketch No. 6, are all to be traced among Dr. Schliemann's specimens; and then again on the balls some similarity in ornamentation is to be traced.

It would perhaps hardly be right to attach much importance to the

fact, that one or two clay discs were found in Buddhist remains in India, and that discs of somewhat the same type were unearthed at Hissarlik. But here we have, not only pierced discs of type B, but the Volcanoes C and the Balls D, all three types resembling in some degree the three types of Hissarlik and all three types bearing somewhat similar forms of ornamentation.

Again it is to be noticed that the remains at Sankisa are undoubtedly Buddhist. Sankisa as is well known was a celebrated place of pilgrimage, being sacred as the spot at which Buddha is supposed (as described by General Cunningham, Vol. I, Archæological Reports) "to have descended from the Trayastrinsa heaven by the ladder of gold or gems, accompanied by the gods Brahmá and Indra."

The place was visited and described by the Chinese pilgrim Fa Hian early in the 5th century, and by Hiouen-Thsang in the 7th century A. D. A detailed account of these interesting ruins will be found in General Cunningham's Archæological Report above alluded to.

Now the ornamentations on the Terra Cottas of Hissarlik, if they are not Buddhist, certainly bear a close resemblance to the ornamentations on coins, buildings, etc., which in India are generally supposed to be Buddhist

Thus the wheel continually recurs in Schliemann's sketches, together with the Swastika. And what Schliemann calls the Mystic Rose, and Fergusson the Trisul ornament is quite as frequent. The Sacred Tree, the Fire Altar and the Deer are also almost as common. In fact, we have every one of the Buddhist symbols of the well known type of the so-called Buddhist coin, figured in No. 1, Plate IV, Thomas' Prinsep, and of which an engraving is given at page 17 of Fergusson's Indian and Eastern Architecture. Mr. Fergusson points out, however, that there is some doubt whether these symbols really are Buddhist, and at the page above referred to, writes, "One coin of the period is well known. It belongs to a king called Kunanda or Krananda generally assumed to be one of the nine Nandas with whom this dynasty closed. In the centre on one side, is a dagoba with the usual Buddhist Trisul emblem over it, and a serpent below it: on the right the sacred Tree, on the left the Swastika with an altar (?) on the other side a lady with a lotus (Sri?) with an animal usually called a deer, but from its tail more probably a horse, with two serpents standing on their tails over its head which have been mistaken for horns. Over the animal is an altar, with an umbrella over it. In fact a complete epitome of emblems known on the monuments of the period, but savouring much more of Tree and Serpent worship than of Buddhism as it is now."

Dr. Schliemann at page 38 of his work refers to the resemblance between the Terra-Cottas of Hissarlik and those of Italy. This directed my attention to Gastaldi's work. The following extract will show that if it be considered that the resemblance between the remains at Sankisa

and Hissarlik is not established, such doubt can hardly exist regarding the Indian and Italian remains.

Gastaldi says: "There are very many of these objects, for the greater part of Terra-Cotta, more or less discoidal, or conical, or spheroidal, pierced in the centre, to which the Archæologists of France and Germany, as well as our own, have given the name of spindlewhorls. The paste of the spindle-whorls is not, for the most part equal to that of earthenware; instead of the grains of sand, we find powdered carbon and ashes; the colour is ashy in the internal parts, and ash colour varying into vellow and red on the outside. Some few spindle-whorls are black, and of a substance probably similar to the thinner vases, and, like a great number of these, are shining externally as if with varnish. They are very various in form; and although eight different ones have been represented by you, from those which, in the course of the summer, we sent from Campeggine, courteously presented by the brothers Cocconi, not one represents the other six, collected in the sequel, in the marl-beds. Some few bear marks scratched upon them, and are among those you have had engraved (Fig. 25).

"Besides all the spindle-whorls of earth, there were dug up from the marl-beds of Castellazzo di Tontanellato, three others, which are cut out of different substances. One was made out of a stag's horn, it is in the shape of a cone, and is very highly polished; the second of stratite, of a greenish tint, and spheroidal; the third, of a whitish limestone (calcare), is disc-shaped, brought to a high degree of polish, and certainly manifests an advanced epoch in art among the people who used such implements. Among the objects in the Museum of Antiquities at Parma, which are of uncertain derivation, there are twenty spindle-whorls, some in limestone, stratite, and even amber, but the greater part of earth; some are polished, some are ornamented with circles, concentric with hole pierced in them, or in concentric lines disposed in groups on the back of the spindle-whorl. We find among these the transition from the more depressed discoidal form, almost medallion (nummulik) to the acute conical. Some one of those in terra cotta is said to have been collected from the ruins of the Roman City of Velicia. The different forms, finish and substances of the spindle-whorls would lead us to suppose that they must have served for various uses in proportion to their diversity; perhaps the most beautiful and carefully worked were amulets, or else buttons; the others weights, used either for nets or in weaving."

"Besides all the earthenware and all the spindle-whorls which we have spoken of, we meet in the marl-beds with other small objects in earth, badly baked, in form disc-shaped, without any hole, sometimes ball-shaped (pallottola), of which it is impossible to divine the use which they served." (Lake Habitations and Prehistoric Remains in Northern and Central Italy. B. Gastaldi, pp. 44, 45, 46, 47.)

In Italy these mysterious articles are found of clay and marble, as in India. The ornamentation is the same and in Italy also are found the disc-shaped Terra Cottas without any hole similar to those of North Western India. It is hardly necessary to burden this paper with any more sketches. The Italian remains are almost exactly the same as those of Schliemann, but I cannot resist the temptation of copying the specimen marked 8 B which will be found figured at p. 45 of Gastaldi's work. It is almost identical with No. 12 of those figured by me.

Next as to the use to which these remains were placed. Dr. Schliemann discusses the subject at length in several places in his valuable work on Troy. And it will be seen that Gastaldi is puzzled as to their significance. Dr. Schliemann arrives at the conclusion that, although some of them may have been used as spindle-whorls, the greater number of them were votive offerings. And Gastaldi considers that some at least were amulets. symbols on most of those found at Hissarlik would seem to leave little doubt of their religious character. Of the Indian specimens, it is not easy to say why some should have the central hole and others should be unpierced. But, if they are votive offerings, the fact that the pierced ones were found in smaller quantities at Sankisa than those without the hole. may possibly be explained by a practice, which was noticed by me years ago at some shrines of pilgrimage in the Central Provinces. There the pilgrim. when he makes a vow or implores a favour, smeares his right hand with red colouring matter, and impresses it, fingers upwards, on the wall of the temple. leaving there a mark like the Red Hand of Ulster. If the favour, the birth of a child or whatever it may be, is granted by the presiding deity, the pilgrim is supposed to return to the shrine the following year, and to impress on the wall a similar mark, the fingers of the hand this time pointing downwards. It was very noticeable that the latter marks were well in the minority, and it was carefully explained by the local priests that this was not to be accounted for by the supposition that the deity was slow in his favours, but that, in truth, the suppliants, when they had obtained what they wanted, were not always mindful to return and to fulfil their vows. Perhaps in this way the proportion of the unpierced to pierced discs may be explained. The unpierced ones being offered when a favour was implored, the pierced ones when it was obtained.

Be this as it may, the view that these discs are votive offerings is supported by the religious character of the symbols, already alluded to, found on the whorls of Hissarlik and Sankisa. Since I commenced to write this paper, I have received a copy of Alabaster's "Wheel of the Law." At Fig. 8 A will be found a copy of the sketch of the Buddhist wheel of the

law given in that work. And it is almost unnecessary to point out the resemblance which the highly ornamented Disc No. 7 bears to this sketch. The other discs, though not so elaborately ornamented, seem to adopt the same idea. No. 11, as far as ornamentation is concerned, undoubtedly resembles a wheel, though, as the section will show, it can never have been used, as some of my friends have suggested, as the wheel of a toy cart; nor indeed are there any marks of wear on any of the wheel-shaped discs to support the view that they were used for miniature playthings of this description. It seems much more probable that they were votive offerings intended to represent, more or less the Buddhist wheel of the law, similar to that stamped on some of the coins recently submitted by me to the Society.

The view that these were indeed votive offerings, and not toy cart wheels or pachisi or draughtsmen, as some have suggested, is further borne out by the large numbers of clay discs, of a somewhat similar type, but bearing on them the well known Buddhist formula, found in the same neighbourhood. These seals, as they have sometimes been called, from their bearing a seal-like impress, have been figured by Moor in his Hindu Pantheon and have been described by General Cunningham, by Dr. Rajendralála Mitra, C. I. E. and others. General Cunningham, if I remember right, found large quantities of such "seals" made of lac in the Buddhist ruins of Behar. Though my stay at Sankisa was short, I succeeded in obtaining a considerable number of these seals. Many of them are from the same stamp. Others from different moulds bear the same well known formula commencing "ye dharma hetavo." The character of the legend in all these cases is comparatively modern. Those, however, marked 1 and 2 Plate XV bear the formula in the Gupta character. Others again marked 3 to 6 are deserving of notice from the variety of their ornamentation. They would seem all to have been made and stamped, in what I may call, a cushion-like fashion, after the manner of the quaintly-shaped Mitra coins recently submitted by me to the Society. Some of these seals are I think worthy of being figured in the Society's Journal.

There can be little doubt that these so-called seals, bearing the Buddhist formula, are votive offerings. A friend of mine, Mrs. Murray-Aynsley who recently travelled through a portion of Ladakh, brought me thence two stones, one inscribed with a portion of the Buddhist Formula, Plate XV, No. 7, the other bearing a conventional ornamentation. That these stones are offered in the present day, will be seen from the following extract from Mrs. Murray-Aynsley's work entitled "Our Visit to Hindostan, Kashmir and Ladakh," p. 88.

"We there first saw some of the walls called Mánés, which are formed of stones placed one upon the other without any mortar, and are

usually about four feet high, and four feet wide. Some of these walls are as much as a quarter of a mile in length, and are made, we were informed, with the following object. When a Buddhist undertakes a journey, or makes a vow, he chooses a flat stone, takes it to a monastery, and gets a lama (or monk) to engrave some rude characters upon it, which are said to be usually, 'Om mani padme Om,' which has been translated to mean, 'All hail to the jewel in the flower of the lotus!' though some give other interpretations to these words. When his stone is thus prepared, the individual places it on the top of one of these walls, which on their upper surface are almost covered with such engraved stones. Thibetans when passing these walls, always keep them on their right hand, and frequently go out of their direct road in order to do this."

There would seem, then, to be little doubt that the Terra-Cottas, plain and ornamented, and those also bearing the formula of the Buddhist faith, were votive offerings of a by-gone age.

In what little I can do to further the objects of the Society, I generally try to content myself with bringing facts to notice, and pointing out the resemblance between the remains found in India and those discovered in other parts of the world. It must be left to those who are better informed than myself, or who are more fortunate in being able to consult what has been written by authorities on the subject, to determine whether there is any real significance in the resemblance between the remains found at Sankisa and those of Hissarlik and Italy. I am not unprepared for the argument that a knife is a knife all the world over, and that this form of implement must have suggested itself to all people at an early stage of civilisation; and that the fact of implements in the form of knives having been found at Hissarlik and at Sankisa would not be sufficient to establish any connection between the settlers at these widely separated sites. It may also be urged that earthen spindle-whorls might naturally enough suggest themselves to different races situated far apart from one another. But surely there is something more than a chance resemblance in the several types of these remains and the style of their ornamentation? And does not the continual recurrence of, what we call, the Buddhist symbols on the Hissarlik finds, suggest the possibility of Hissarlik and Sankisa having been colonized by branches of the same race, be it Buddhist or not. one of which striking west from some point in Central Asia, found its way to the shores of the Mediterranean, whilst another, taking a southerly course, established itself in the Gangetic valley?

Supplementary Memorandum.

(With a Plate.)

Since writing this Memorandum on spindle-whorls, I have received from Sankisa a further consignment of these peculiar remains.

In my paper recently read before the Society I mentioned that the flat discs, plain and perforated, were to be found in large quantities. I have received a further large consignment. But the perforated ones are much less numerous than the others. It is unnecessary to send any more of these types.

Of what Schliemann calls the volcano-shaped Terra Cottas I have received several more. This bears out my view that they are numerous. Nos. 1 and 2, Plate XVa, are interesting from their decoration. The one it will be seen is decorated on the top. The other is decorated on the base with what would seem to be a flower and in a manner resembling the Hissarlik types.

I send also three more balls, Nos. 3-5. These are ornamented with stars, crosses and with lines. Several others of the same type have since reached me.

I have obtained many more clay seals of the same type as those already sent. One only marked No. 6 is different in its character from those already submitted to the Society.

No. 7, is a fragment of pottery highly ornamented with the rosette or wheel of the law, or whatever it may be, common on Buddhist remains.

I should be glad of any explanation of the peculiar piece of soapstone marked No. 8. Its ornamentation is curious. The grooves at the top will be noticed. It may possibly have been worn as an amulet.

Further enquiries are being made at Sankisa, and I hope to be able to obtain many more specimens showing various forms of ornamentation.

It has been suggested that the curious balls of various sizes with their different markings may have been intended to represent the sun, moon and stars.

I see that the genuineness of the antiquities found at Sankisa and Behar is doubted by some. But these sites do not see on an average one European visitor a year; as yet no one save myself has collected there these specimens, and so it is hardly to be supposed that the native mind has yet been sufficiently prepared to attempt to provide forgeries for a possible future trade in such articles.

Note on some copper Buddhist coins.—By H. RIVETT-CARNAC, Esq., C. S., C. I. E., F. S. A.

(With two Plates.)

I send for the inspection of the Society, some coins, mostly Buddhist from my Cabinet, some of which may perhaps prove of interest. They will not all, I think, be found described or figured in the works most readily accessible to Members, and it is possible some of them may be new types. I am indebted to Mr. A Carlleyle of the Archæological Survey for the readings on the coins.

Plate XVI, Nos. 1, 2. Legend Vaisakha Devasa. Two coins, if they may so be called, of the same type differing in size. They are evidently casts, i. e., have been made in a mould prior to the time the art of stamping was discovered. On one side is the Bull taking here the place of the Elephant common to the earlier coins. The name tolerably clear above the Bull. On the obverse what looks like the Trisul of the Sanchi Topes, and the snake. I should be glad to know if this coin is known to the Society?

- No. 3. Legend Rája Kamuda Senasa. This coin resembles the preceding ones in several respects. The Bull again occupies the most prominent place. The legend is beneath the Bull; near the head of the Bull is the sacred tree. Behind the Bull is the snake. At first sight this has the appearance of an elaborate tail of the Bull. But a careful inspection will show that the tail is separate and quite distinct. On the obverse is the well known ornament which I think Fergusson calls the "Trisul," though it is different enough from Shiva's trident. It will be noticed that the marks on these coins have apparently been stamped in the same manner as those of the Mitras, found near Barelli and recently submitted by me to the Society. The Bull and Legend have been stamped in, as if with a square seal, and cover but a portion of the circular piece of metal. Perhaps these coins represent some of the earliest attempts at coining?
- No. 4. Legend Aja Varmma or Asha Varmma; a coin of the same type as above; the legend differing.
- No. 5. Legend Maphaba Varma. The same remarks apply here also. The coin has been cut in two, and was just going to the melting-pot when I was fortunate enough to rescue the two pieces from a quantity of rubbish. It is to be feared that a good many coins are thus lost to us. All the above were obtained by me at Faizabád.
- No. 6. Maha Satama. A coin apparently of the same type as above but in bad preservation.
 - No. 7. Satya Mitrasa.

No. 8. Ayu Mitrasa.

No. 9. Saya Mitrasa.

All of the well known "Cock and Bull" type, but new names I believe.

No. 10. Yaya Mitra (two specimens).

Plate XVII No. 11. Vyaya Mitra.

These coins seem much older than the preceding ones.

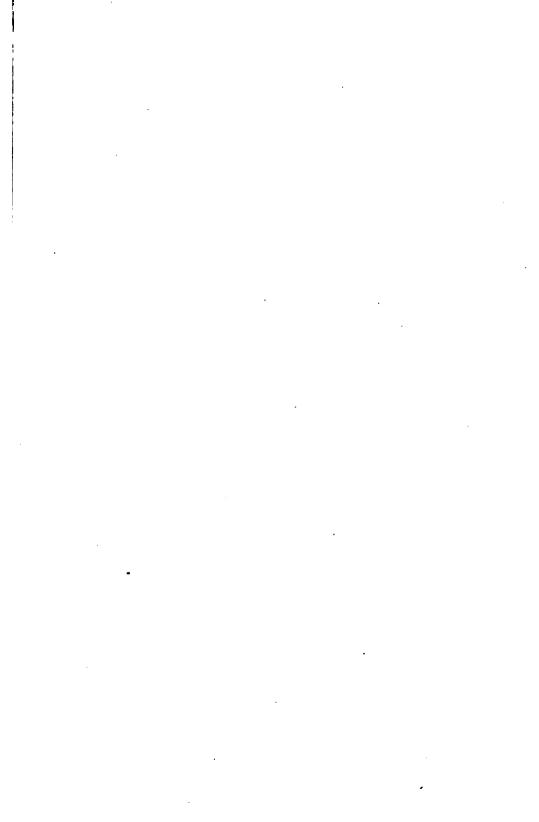
No. 12. (Lion) Laranga or Larata or Lájasa. (Tree) Súgáta-Yana-pya.

This coin is quite a different type from the preceding. On one side is a Lion much resembling the carvings found among the ruins of old Buddhist Temples.

- No. 13. A pretty little Buddhist coin of a type I have not yet seen figured. The sacred tree is encircled by the snake forming a sort of resette in the centre of the coin.
- No. 14. These three little oddly-shaped specimens have all well stamped on one side what looks like the conventional Heraldic Lion. On the other side may be traced marks somewhat resembling the sign *Pisces* of the Zodiac.
- No. 15. Two specimens of a coin which is perhaps new. On one side what looks like a Fish as in the preceding coins, on the other a Thor's Hammer (?) or perhaps the sign of Saturn combined with some other sign in such a manner as to form a monogram?

No. 16. Three little coins of sorts.

I should be glad for information regarding the dynasties, dates, &c., of these coins.





ASIATIC SOCIETY OF BENGAL

Part I.-HISTORY, LITERATURE, &c.

No. IV.-1880.

Remarks on the Afgháns found along the Route of the Tal Chotiali Field Force, in the Spring of 1879.—By LIEUT. R. C. TEMPLE, B. S. C., F. R. G. S., M. R. A. S. &c. (With 3 Plates and 2 Maps).

(Concluded from page 107.)

PART II.

III. Distribution of the Tribes.

In the above description of the Tribes along the Tal Chótiáli Route their distribution en route has been but briefly referred to. In the next Table the names of the tribes inhabiting the villages on the accompanying map are shown. And it will be seen that as a rule the Pathán Tribes and Sections stick pretty well together and are generally to be found in certain compact districts and nowhere else.* Thus Achakzais are confined to the region about To'ba and the Kho'ja Amrán range, and the To're Taríns to the Pishin Valley. Among the Kákar sections the same thing is to be observed. The Amand Khe'l occupy the country about the north of the Pishin to Mt. Kand and the Sulimán Khe'l the range dividing the Pishin and Do'r Valleys, the Mehtarzais all the country to the north of the R. Ro'd Gorge and the Pánízais that to the south of it and so on. Even where the country seems to be pretty well divided between sections, as the Do'r

[•] Villages of mixed populations are to be found in the more settled parts, such as the Pishin, Do'r, and Gwa'l Valleys, though not commonly, and when it is said that a certain village is occupied by a certain subsection or section it is meant that the main portion of the inhabitants belong to it. As a rule, however, villages are not mixed.

them, and a few Spin Tarins are said to be about Krizar in the Pishin, but practically there seems to be no communication between the Spin and the To's Tagins. The Dunars probably occupy all the country to the south of the SIO'R Valley from Mt. MAZHWO to the TAL Valley, but in the ZHO'R Valley the tribes seem to be mixed, though the Valley and the Ro'D River Gorge, it is divided only among a few, as only Bazais, Shamozais, Surgarais, Malagais, Sayads do not seem to have penetrated into the Kákar country beyond the R. Ro'n, near which there is one village of IsA' KHE'LS and SARA'NGZAIS amid the surrounding MEHTARZAIS and PANIZAIS are found in the districts in question. ZHO'B Valley Kákars seem to be a section apart and to hang together.

District.	PISHIM. Do. Do.	ååå ååå	è è è	ÄÅÅ	i i i	ទំនំ	ŠÅ:	ŠŠ	å
Village.	Po'palzai Asad Kha'n Khu'shdil Kha'n	Mi'bralam Kha'n Ka'kozai Kala Abdulla Kha'n	TANGAI MADAT HABYBITTA	BADWA'N MOHAMMAD SA'DIK	La't Монаммар Vakı't Dab Кна'ятдаг	Gauri Satamzai	Ali'zai Atá Mohammad	Sopánzai Nu'ezai	SKAN
Subsection.	Sadozai Mohammadzai	Ka'kozai Arda	" H . m',nz.1	LU'R KHA'NIZAI	" Dab Kha'nizai	: :	: :	: :	
Subdivision.	: !	Bara'durzai "	SATARCAT		:	::	:::	::	:
1. Section.	Po'palzai Ba'bakzai	ACHAKZAI	4.2	Badozai n Kha'nizai	2 2 2	Kli'zai p	2 2	NU'RZAI	Kulázai
Tribe. Division.	Zı'bak			To'R Tarín					
Tribe.	Duba'ni Zi'bak			Tari'n					

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IV. Polity.

The portion of Afghánistán along the route may be divided into that formerly subject to the Amír of Kábul, and that acknowledging no superior authority, into, in fact, the Amír's Territory and the country of Independent Tribes. The Amír's power never seems to have extended beyond the Do'r Valley to the eastwards further than Isaf Kach, or further north in that direction than Mt. Kand, i. e., the inhabitants of the Zho'b Valley and all the country south of it eastwards of the Do'r Valley have never recognised him as their ruler. The tribes then under the Amír's sway were the Duránis, the Tor Taríns and such Kákars as inhabited the Do'r and Gwál Valleys, while the bulk of the Kákars, the Lúnis, the Zarkháns and the Spín Taríns have always been independent. For the purposes of this paper the country will be divided into Amír's Territory and Ya'ghista'n or Independent Territory.

Under the Amír, Government in our sense of the term there was none, though the head of the Government nominally ruled through his Sirdárs or heads of tribes and sections, having, however, little real control over them. And how this system was worked has been thus described.* "The Sovereign is absolute and makes any and every change which may appear to him necessary or proper in the government and administration. He can dispose of the lives and property of his subjects and is kept within certain bounds in these respects only by the calculations which prudence dictates. Religion is the counterpoise to his authority. This gives the clergy great influence, one that he might try in vain to subject to his will and pleasure, and vainer still would be the attempt to infringe and invade the rights and privileges of the sirdars or chiefs of tribes, who would never consent to resign a certain influence in the affairs of government. It may be said in Afghánistán that there are as many sovereigns as sirdárs, for each of them governs after his own fashion. They are jealous, turbulent and ambitious, and the sovereign can restrain and keep them in some order only by taking advantage of their rivalry and feuds and opposing one to the other. There is no unity, nothing is permanent, everything depends on the pleasure or caprice of a number of despots always at variance with each other and making their tribes espouse their personal quarrels. A constant feeling of irascibility is the result which finally leads to sanguinary civil wars and throws the country into a state of anarchy and perpetual confusion. sirdars are at one and the same time the strength and the curse of the monarch. Prompt to take arms and defend him when a good understanding between them exists, they are as ready to revolt against him when they find or think they have the smallest interest in doing so. In anything,

however, to which they are disinclined, they would not obey even the sovereign of their choice but with reluctance; moreover they are always impatient to see him replaced by another from whom they hope to obtain greater advantages. Each subdivision of a tribe is, according to its numerical force and extent of territory, commanded by one or more sirdárs. These chiefs may be compared to the dukes and barons of the middle ages in France, the more powerful to the knights bannerets, and those having authority over only a few families to the esquires who in time of war enrol themselves and their men under the orders of the chief that inspires them with the greatest confidence and can pay them best.* most powerful amongst them are caressed by the sovereign who attaches them to his interests much more by the concessions he makes than by the fear he inspires. Ordinarily and with a view to preserve a nominal authority over them, he remits the whole of the taxes and imposes in their stead the obligation to furnish a contingent of troops in the event of war being declared against him by his neighbours. This wretched system gives too much power to the Sirdárs. The sovereign is at their mercy, and it is the ambition of these men that gives birth to the numerous civil wars in Afghánistán: for they are constantly in revolt."

Such being the state of civil government in the Amír's Territory, the only difference to be observed in the Independent Territory is, that the local Sirdár, or whatever other local chief happens at the time to be the most powerful, is absolutely uncontrolled even by the semblance of superior power. The above-mentioned independence of the Sirdars and their impatience of superior control is to be observed in numerous instances even in the Kháns or rulers of villages, being of course more pronounced in Ya'GHISTA'N than in the Pishin and other portions of the Amir's Territory. example. In the Pishin the ruins of a village called SAYAD SA'LO or URUMZAI were passed. It had been but recently destroyed by a more powerful neighbouring village called SAYAD PAIND in a quarrel between the two Kháns. The Unumzais had to fly altogether out of Afghán Territory across the Belo'ch Border to Khu'shla'k where they settled. They appear to have been hunted across the Border by the other village without any attempt at interference on the part of the neighbours. Again not far from this last were two villages, Old and New Ma'LIKYA'R, the old village having been deserted on account of an internal dispute and a new site selected a few miles off. The same thing was to be observed at a place called WARIA'GAI in the Bo'BAI valley, where an evidently lately ruined village called Old WARIA'GAI was passed. I was informed it had become so about five years before on account of an internal squabble. Like the

^{*} The very remarkable parallel to be observed politically between the Afgháns and the Mainotes of Greece I have elsewhere pointed out. J. U. S. I. of India, 1880.

Barons of European feudal times these village Kháns seem to exercise the right of private war on their neighbours without control or interference. Certain villages have acquired an evil name for this kind of truculence. KACH in the SHO'R valley is such a village. Nor is a fight or quarrel always a necessary reason for a change of site, any caprice or change of owners is sufficient. A case in point is the fort of Ha'jí Kha'n (Amand Khe'l) in the Pishin. And towards the Border by the HAN Pass, in the long stretch of disputed land about the passes, ruined villages are naturally to be seen in the more exposed parts of the LU'NI KHE'L, ZABKHA'N and SPIN TARIN country on the Afghan side and in BA'RKHO'M on the Beloch side, the result of endless border raids. The lawlessness of the GHILZAIS along the roads between Kandahár and Kábul has been noticed by former travellers. one of whom has written: " Every man distrusts his neighbour or is at open feud with him. It is the custom of the country to throw a heap of stores over murdered travellers, and in the ravine leading from SHILGAR to ZURMAT (Ghilzai country) the frequency of these heaps is sickening. In many cases they are to be found at the closed end of the ravines showing how the poor travellers have run as far as possible and then been cut down." The same may be remarked of almost any part of the Kákar country, and in that portion about Mts. MAZHWÖ and SPINSKHAR where the heights are crossed between the USH and NANGALU'NA Passes, there is a long narrow valley between low hills to be crossed, and in this it is hardly any exaggeration to say that these heaps may be seen but a few yards apart. The reason appears to be that persons going from the SRO'R and BO'RAI Valleys or the DUMAR country from the south towards the Pishin must pass this way through a country which is for some thirty miles utterly uninhabited. In the wild uninhabited border tract about the HAN, HANOKAI and TRÍKH KURAM passes they may be seen in clusters in many places telling of some fights either among the local tribes themselves or with the Belóchia.

The mutual distrust among the tribes and even sections inhabiting different districts is so great as to result in an almost absolute ignorance of each other. They appear to have a real fear of going into each other's country and invariably give one another a bad character. Thus Ka'kars are an abomination to Taríns and Acharzais and Lu'nis to Ka'kars, while the wretched Zarkha'n is harried on all sides. The I'sa' Khe'l Kákars and the inhabitants of the Gwa'l valley manifested an extraordinary fear of the Pa'nízai Kákars of the hills to the east of them. Sandar Khe'l Kákars could not be induced to venture into the neighbouring Lunf territory and I did not personally meet a man who had been towards Ghazni by the To'ba Plateau or along the Tal Chótiáli Route. A guide

[·] Macgregor's Gazetteer.

from the Do'f Balley an I'sa' Khe'l, showed the liveliest anxiety to get back again from Ispira Ra'gha and would not venture into the Zakhpe'l Territory and an old Utma'n Khe'l guide told me he had never ventured beyond the territories of his section of the Kákars.

The structure of the houses in the more civilized parts, which in the hills consist of nothing more than rough mud and thatch, is a further proof of the general lawlessness of the population. In the Ghazgai, Bo'rai and Lu'ni Valleys, among the Utma'n, Sandar and Lu'ni Khe'ls a house is nothing less than a fort round which, frequently within walls, is the cultivation necessary to support life, and when the crops are gathered they are stored in little round mud towers which I have shown elsewhere to contain just enough grain for one family for a year. In the Do'r Valley, however, I only saw one fort in a village called Kha'nizai Ka're'z and in the Pishin the villages were all open. Life in the Pishin among the Tarins and Sayads seems to have been much more settled than elsewhere, but the Achakzais have a bad name as thieves and robbers.

Government among the Duránis differs considerably from that of the other tribes, noticeable chiefly in its regularity and order. Each section of the Duránis is governed by a sirdár and each subsection by a MALIK or The principle is election qualified by hereditary claims, i. e., the sirdar is elected from the chief family of the clan or section, and the malik from the chief family of the subsection. The sirder has a deputy or naib always a near relative appointed by himself. Their occupation of the land is directly from the Amír on the condition of military service. themselves the Duránis do not as a rule resort to private revenge, hence internal blood-feuds do not exist among them as among other tribes. disputes are settled by the "JIRGA" backed up by the sirdár, by the interposition of the elders, by friends of the parties, by the priests (MULLAS), or by the civil and ecclesiastical judges (Ka'zi's). The ACHARZAIS, the section of the Duránis met with en route, are the wildest of those inhabiting South Afghánistán and are entirely a nomad race, hardly ever living in a They inhabit the To'BA Plateau and during the summer roam over it with their flocks and spread themselves over the lower slopes of the KHO'JA AMRA'N Range about the KADANEI and Pishin Valleys during the winter, where their black tents or KIZHDAIS are to be seen everywhere. Their Sirdar is at present Mir Aslam Kha'n, son of Mir Abdulla Kha'n who built the well known fort or village of that name at the Pishin entrance of the Kno'JAK Pass.

The Kákars and Independent Patháns do not apparently recognise any particular sirdár or chief, and probably any man rules who has the requisite force of character, though birth, on which an Afghán always sets such an extravagant value, is pretty sure to exercise considerable weight in

the selection of a ruler. Thus Samandae Kha'n of the Lu'nis, now their leader, is the son or near relative of Paind Kha'n their late ruler. Sha'h Jeha'n of Khasno's (Zho's valley) is a great man among the Kákars and Gwarat Kha'n among the Sandae Khe'l.

V. Civilization

As regards civilization, except as to dress, methods of cultivation and dwellings, but little could be observed in such a hurried journey as mine.

On the first point there is little to be noticed beyond what has been already written about it by the authors of the following: " "The Afghans wear their clothes long. They consist of two large very ample robes and are either of cotton or a cloth made of camel's hair + called BAREK: this is the dress of the people. The only difference in the garments of the rich is the material, which is silk, cloth or Kashmir. In summer they are made without lining, but in winter they are wadded with cotton or lined with fur. The under-garment is confined by a piece of muslin or long-cloth which is wound round the body. The outside one, and sometimes a third robe, is used as a cloak, and a person would be considered as wanting in politeness if on visiting a superior he did not put it on. The shirt is very full and the sleeves which reach below the hands particularly so. 1 former is open to the sides from the neck to the waist and falls over the trousers, and these which are excessively large, open at the foot and are drawn in at the waist with a string. The head is covered by an enormous blue or white turban and the feet with slippers without quarters. The upper classes are for the most part simply dressed and consider luxury in this respect as enervating, but some young chiefs have their robes embroidered with gold thread and ornamented with gold lace. This is done in the harems by the women who excel in this kind of work, particularly in Kandahár. The Afgháns are not careful of their clothes and soil them the very first day they are put on, for they squat on the ground without taking the least thought whether the spot on which they sit is clean or dirty. They never change their garments, not even the shirt, until they are completely worn out, and as they rarely wash themselves they are constantly covered with vermin great and small."

In the matter of dress excepting the Achakzais, the Duránis show as usual a considerable superiority over the other tribes. The following was found to be a fairly true description of their dress.§ "The Duránis about

Macgregor's Gazetteer.

[†] A thick white material like felt for the outer cloak is common about Kandahár and the Pishin, and to this is often added a "póshtín" or coat of skin with the hair turned inwards.

[‡] The cloaks about Kandahar and all over the South have frequently long false alceves reaching nearly to the ground.

Macgregor's Gazetteer.

towns, most of those in villages and all those of the shepherds who are in easy circumstances wear a dress nearly resembling that of Persia, which though not very convenient is remarkably decorous and with the addition of a beard gives an appearance of gravity and respectability to the lowest of the common people. The poorer Duránis, particularly among the shepherds, wear a wide skirt and mantle. The poor only change their clothes on Fridays and often only every other Friday, but they bathe once a week at least, and their prayers require them to wash their faces, beards and hands and arms many times in the course of the day. The little Kháns all over the country wear the Persian dress. Their coats are made of silk, satin, and a mixture of silk and cotton called GARMSUT, and sometimes of brocade, and they all wear shawl girdles and a shawl round their caps. Their cloaks also are of broadcloth often red or of silk of different colours." To the Achakzais the above remarks hardly apply except in a very general way. Their manner of dress is the same, but they seldom or never change their clothes as long as they last, and consequently go about in filthy rags often half tumbling off them. They are in dress as in everything else the most uncouth and uncivilized of the great clan to which they belong.

With regard to the Sayads, Tarins and Kákars, etc. met with en route there is little to be remarked except that they all wore the unmistakeable Afghán dress. In the more civilized valleys as the Pishin, Dóf, Gwál, Ghazgai and the Bórai the dress was better and more respectable answering to the above given description of the Duráni dress. But in the hill districts especially in the elevated region about Mt. Mázhwö the dress merely appeared to be a collection of dirty rags, the remains of what was originally the national costume. The Pánízais, Mehtarzais, Sarángzais, Amand and Sulimán Khe'ls, Dumars and Zakhpe'ls among the Kákars bear off the palm for dirt and squalor. The Isá, Utmán and Sandar Khe'ls are much cleaner and neater in appearance and altogether better dressed. The Lu'nis and Zarkháns met with wore the dirtier and more ragged class of dress, but with the exception of the Sandar Khe'l Kákars the Pishin Sayads were the best-dressed people I recollect to have seen on the road.

The dwellings were found to differ considerably in different parts of the route. Those about the Pishin and Dof valleys were apparently constructed on the same principles, whether Sayad, Tarin, Achakzai or Kákar. Tribe indeed does not apparently affect the construction of dwellings so much as locality.

The most noticeable construction of hut is that to be found every-

Among the Sayads it was to be observed that the articles of dress were not homespun but of foreign manufacture, obtained probably during their many visits to Hindustán.

where to the west of the Kho'ja Amrán Range. These are square dwellings of mud (kachchá) bricks about 20 feet by 12 feet and some 6 to 8 feet high surmounted by one or more small domes. In this method of construction wood is not required for the roof, a great consideration in a treeless country like South Afghánistan (vide fig. 1). But the hut of the Pishin Valley and neighbourhood has a sloped roof (fig. 2) supported on strong rafters, thatched and finally covered with mud. This roof is by far the most valuable part of the structure, and during their numerous migrations they carry away the wood-work to be set up in the new site. The usual measurements of such a hut are roughly: length 18 feet, breadth 6 feet, height of wall 6 feet and of roof 10 feet. They have no windows but usually three small holes at either end for air and smoke. A hut generally stands in a small yard surrounded by a rough stone or mud wall and sometimes there are two or three huts in the same enclosure.

As the mountainous regions between the Pishin and Shor Valleys are approached, the huts become much rougher though constructed on the same principles. They are irregular structures of mud over foundation walls of large unhewn and uncemented stones from the nearest stream or hill-side, and frequently also the back wall is the hill-side itself. The roof as before is of thatch covered with mud. There is also often a small window hole and the door frequently stands out from the roof on the principle of a dormer window (fig. 5). The general dimensions are height 10 to 12 feet, height of rough stone-work 3 feet, of mud wall 1 to 2 feet, length 10 to 12 feet.

Up in the mountains and in the upper gorge of the R. Ro'n the dwellings degenerate into a mere irregular thatch of leaves and brushwood of a pyramidal or conical form supported by a centre pole and having a door or entrance at one side. Frequently a hole is scooped out from the hill-side and thatched in, so as to form a rough kind of hut or dwelling. These conical huts measure generally: height 10 feet, diameter at base 10 feet (vide fig. 4).

On reaching the lower lands about O'BUSHTKAI, KHWÁRA and CHIMJÁN, a hut very similar in appearance to that of the lower Ro'd Gorge is to be seen, the roof of which is irregular and of thatch covered with mud and supported on irregular rough stone walls cemented, so to speak, with mud. There is usually no gap for a window (vide fig. 8). The measurements are: length about 12 feet, height of wall 3 feet, total height 8 feet.

In the mountainous tract between the Sho's and Zho's valleys the buts are very wretched and have the appearance of being of a temporary character. The floor is scooped out of the ground on the hill-side so as to save a back-wall, and a wall about 3 feet high is built up on three sides

[No. 4.

surmounted by the usual mud-and-thatch roof. The interior height is about 6 feet and the length some 10 or 12 feet, breadth 6 feet.

But on reaching the GHAZGAI and BO'RAI Valleys, i. e., the territories of the UTMÁN and SANDAR KHE'L Kákars, a notable difference in dwelling structure is observable. The houses, rather than huts, now to be seen are of mud. as in Belochistán, Sind and the Panjáb.* In the GHAZGAI Valley they are all fortified after the fashion of these people, having frequently a look-out tower, which is sometimes square but generally circular, attached The body of the building has the sloped thatch-and-mud roof of the Pishin valley. The entrances or doors are very low, being only 3 feet or so in height; the tower has also a separate entrance of a similar construction, and round the top of it is a row of loop-holes. dimensions are: height of wall 4 feet, of hut 8 feet, of tower 12 feet, base of tower 6 feet square (diameter, if round, 6 feet), length of hut 16 feet (vide fig. 9).

In the Bo'rai and Lu'ni Valleys were the best dwellings (figs. 10, 11, 13) I saw outside Kandahár in all S. Afghánistán, and I can hardly do better regarding them than repeat what I have elsewhere said. + "They are no longer huts, but have become houses with dimensions varying considerably: fig. 10 represents one of the smaller ones. They are built entirely of mud with flat roofs from which the water is carried by projecting spouts. They are generally fortified and have towers attached and usually only one door. Fig. 11 represents one of these fortified houses. bulk of the houses, however, in the Bo'RAI Valley are much larger than those above mentioned, and may be described as fortified structures of mud, surrounded by a mud wall some 12 feet high and covering sometimes nearly an acre of ground (vide fig. 13). They have usually several towers attached and one door; within the outer wall are a quantity of fruit trees, and the house probably contains a whole family. Generally also there is a low 3 foot mud wall extending round the fields belonging to the house probably for their protection. Three or four such houses often constitute a village. The fortifications of an UTMÁN KHE'L village are often supplemented by a small regular square mud fort or redoubt with corner towers. a similar description are also to be observed about the SANDAR KHE'L and LU'NI Territory, where the villages are generally a straggling collection of

[•] In the Panjáb the walls of such a house (kachchá makán) are built simply of wet mud (gondha) without foundation (bunyad), then smoothed over with liquid mud (kaigal) and finally covered with a wash of cowdung and mud (g6bri) and often also with whitewash (sufédí) or a coloured lime-wash (rang). The roof (chhat) is of rafters (kharí) covered with a light reed thatch (sirkí), plastered over with mud or earth (mitthí) and cowdung (góbrí).

⁺ J. R. G. S., 1880.

the large fortified houses above described. They have a well-built, substantial and prosperous appearance not often seen in the East. Sometimes a Malik or petty chief will build himself a fort apparently as much for show as anything else. Chiná Ko't in the Bo'bai valley (fig. 14) is such a fort. The main interest in it is that it is quite new, not more than 20 years old, and so is a specimen of the modern method of Kákar fortification. It is on a small isolated hillock rising out of the valley, and is constructed as usual of mud on a rough stone foundation. The owner is one Malik Sandí, an Alízai Sandar Khe'l. The approach is by a causeway of very rough construction, and it is entered as usual by a single door so situated as to be easily commanded. The whole structure covers about an acre of ground'.

The nomadic habits of the Duránis and especially of the Achakzai section of that tribe have been frequently noticed by former writers. Among the Kákars, too, are found several nomad sections, such as the SULI-MAND KHE'LS of the Pishin and the bulk of the PANIZAIS, DUMARS, and ZAKHPE'LS; even the more fixed and agricultural sections of the Kákars, as the Sandar and Utmán Khe'ls, and the Lu'nis have the nomadic instinct strong in them and spend all the hotter weather roaming with their flocks in the neighbouring hills. By far the greater part of the ACHARZAIS have no fixed abode, but live in a curious kind of hut called a Kizhdai, which has been thought peculiar to the Duránis, but as far as I could ascertain, it is common to all the nomad sections whether Duráni The Kizhdai is a structure of bent willow rods or withies covered over with black felt-like blankets and sometimes with black matting (vide fig. 3). There are generally four or five of these willow supports in a row over which the covering is stretched. I saw one in the course of construction near ALIZAI in the Pishin and the method of putting up the supports is that shown in fig. 15. The Kizhdais are very warm in winter and can be made, by opening out the sides, cool and pleasant in summer, and are also, from the closeness of the strands of the covering which swell with moisture, impervious to rain. They have for a nomad race the advantage of being as easily moved as an ordinary tent. In several Kizhdais of a permanent kind near villages I saw a regularly railed in space in the middle for goats and sheep. The usual dimensions are : height 4 feet, length 12 feet, opening or doorway 3 feet by 3 feet.

There are two other kinds of structure which are interesting in this connection. In the Bo'rai valley the Sandar Khe'ls build small circular mud towers of peculiar make (vide fig. 12), raised on piles about 2 feet from the ground, in which they store grain containing as I have elsewhere shown* about enough for five persons for one year. Bhusa (chaff or chop-

ped straw for fodder) is kept in round mud-covered heaps containing about 100 to 200 maunds, as are turnips etc. in England for the winter. Grain of all sorts is also stored in sacks weighing about 100 seers, which are kept in the huts and sometimes buried in some place known only to the owner to save them from the rapacity of the numerous hangers-on of the Sirdárs or of the Amír.

Secondly, ASYAS or watermills are noticeable objects everywhere. Their general features have been frequently before described, as they are common to Afghánistán, Persia and Turkistán, and the following from MacGregor will answer the internal description of them all: "The wheel is horizontal and the feathers are disposed obliquely so as to resemble the wheel of a smoke-jack. It is within the mill and immediately below the mill-stone, which turns on the same spindle with the wheel. The water is introduced into the mill by a trough so as to fall on the wheel. The wheel itself is not more than 4 feet in diameter."* Externally they have always the appearance of the ordinary habitations round them, whatever the prevailing construction may be. They are to be found along the line of a Ku'l or of a natural running stream, and often, to give the water greater power, a portion of the stream will be banked up for some distance before it reaches the mill (fig. 4). The roof is usually on a level with the banks of the stream. In places, as at Alizai in the Pishin, long lines of Asyas and embankments are to be seen along the same stream (fig. 17).

There is little to be remarked under the head of cultivation beyond a notice of such methods of irrigation, etc., as came prominently under observation, for my journey was of too hurried a nature to admit of any investigation. In irrigation considerable skill is everywhere evinced in S. Afghánistán, especially in the direction of Ku'ls or artificial water-courses, of KARE'ZES or underground water-courses, and of groins and river dams. Wells are not seemingly in use for cultivation as in the Panjáb and Persia. The Ku'l is well-known in all the northern districts of India and there is little to be added here, except to notice the general prevalence of this style of irrigation in S. Afghánistán, where along the TARNAK Valley it is used to such an extent as to dry up and disperse the water of the river: a state of things also noticeable along the rivers running towards the Indus and the Kachí Plain of Belúchistán. The entire flow of many mountain streams is frequently thus utilised, and great skill is often to be observed in the preservation of the levels; and in one place in the Bo'RAT Valley I observed a Ku'l carried under the stony bed of the R. To'r KHAIZE' by a rough but practicable syphon.

[•] Such watermills are common enough in the Himalayan districts, and I have in my possession a wooden bowl turned by a lathe worked by a water-wheel in a remote valley in Ku'lu'.

The Kirr'z has been frequently noticed by travellers in Central Asia beginning with Marco Polo, who, according to Ramusio's version, writes about "the wearisome and desert road in KEBMAN (KIBMAN)", that* "after those days of desert you arrive at a stream of fresh water running underground, but along which there are holes broken in here and there, perhaps undermined by the stream, at which you can get sight of it. It has an abundant supply and travellers worn with the hardships of the desert here rest and refresh themselves and their hearts." Col. Yule remarks on this (p. 116) "the underground stream was probably a subterraneous canal (called KANAT and KARR'Z) such as is common in Persia, often conducted from a great distance. Here it may have been a relic of abandoned cultivation". Khanikoff on the road between KIRMÁN and YEZD, not far west of that which I suppose Marco to be travelling, says: "At the fifteen inhabited spots marked on the map they have water which has been brought from a great distance and at considerable cost by means of subterraneous galleries to which you descend by large and deep wells. Although the water flows at some depth its course is marked upon the surface by a line of more abundant vegetation." Elphinstone says he has heard of such subterranean conduits 36 miles in length." MacGregor describes the construction of a KARE'z thus: "a shaft 5 or 6 feet in depth is sunk at the spot where the stream is to issue on the surface, and at regular intervals of from 20 to 50 or more paces in the direction of the hill, whence it has been previously ascertained that a supply of water will be obtained, other shafts are sunk and the bottoms of all connected together by slightly sloping tunnels. The depth of the shafts increases with their distance from the original according to the slope of the ground. Their number and the length of the Ka're'z depends on the supply of water met with, the quantity required and the distance of the habitable or cultivable spot. The position of the shafts is marked by circular heaps of earth on the surface and their orifices are usually closed, the covering being removed at intervals of a year or more for the purpose of cleaning and repairing the shafts and tunnels. Much experience is required to select a spot from which a plentiful and lasting supply will be obtained. Some Káre'zes afford a constant supply of water for ages whilst others become exhausted before they have paid for the cost of construction." To this I may add the advantage of the KABE'Z is the prevention of the rapid evaporation the water would undergo in such a climate if freely exposed to the air. Kire'zes are frequently very deep, 40 feet and more below the surface. Judging from one seen under construction in the Pishin, the shafts or wells are sunk as usual with pick and shovel and with crate and windlass, and the water-passage tunnelled out afterwards. One cause of the per-

• Yule's Marco Polo I, 115.

manent drying up of Kárezes is the shifting of the subterraneous water lodgment, and it is not uncommon to see parallel lines of Kárez wells close to each other. Kárez digging is a special occupation, the Ghilzais being famous for it.

The system of irrigation by tanks or open reservoirs so successfully used in Maisu'r and many parts of the Madras Presidency is only sparingly used in Afghánistán, and I only observed a few small irrigation tanks in the Pishin and Kadanei Valleys, though from the universal presence of uneven country in Afghánistán it would appear that the Maisu'r system of bands and tanks should succeed as a means of irrigation if regularly introduced.

The method of irrigation by means of groins and reclamation of river-beds to be observed in the high lands along the valley of the R. Ro'd and in the Sho's Valley in the neighbourhood of Chimján is very remarkable. These groins are constructed at a great cost of labour with rough stones and tree trunks and are frequently turfed over and planted with willows and small bushes. In the Ro'd Gorge the main portion of the cultivable land has been obtained in this way.

There is one more point to be noticed in this connection. Elphinstone states (Kingdom of Kábul) that it seems to be only in the very poorest parts of the country that land is allowed to lie fallow for a year. This, however, is apparently not the case in the Kákar Country generally, especially in the Bo'rai Valley, where the large area under cultivation is only to be accounted for by a large portion of it being allowed to lie fallow every year.

Madder, which, as MacGregor observes, is common in the west of Afghánistán and sold all over India by Patháns as Majít or Manjít, is to be found in the Do'f Valley in highly cultivated lands deeply furroughed and manured. The leaves are used for cattle and the roots for the dye. This cultivation is elaborate, good and costly, and the yield in the Do'f Valley is said to be worth Rs. 1000. The people there believe apparently that it is not grown elsewhere; it is, however, to be seen about Takht-i-Pu'l near Kandahár.

Graveyards deserve mention in this place. These are to be found scattered over the land in places quite remote from population. In fact the dead are frequently carried to long distances from their place of decease in order to be buried at a particular spot. This system of carrying the dead to certain places belonging to the family is prevalent among the Panjáb Muhammadans, the YU'SUFZAIS and other such Patháns as inhabit British Territory. I saw the body of a SUBAHDÁR of the 26th Panjáb Native Infantry who had died at Quetta being carried down the Bolán Pass to be buried in the Pesháwar District, and on the Panjáb Railways

there are special rates and arrangements for the carriage of corpses. On the other hand among the Pathans travellers and often the dead on a field of battle are buried where they die, and the GHILZAIS are always so buried. The reason given for conveying corpses to certain burial grounds is that a Pathán should be buried by the tomb of the Pin or Saint he followed in life, at whatever distance it may be. This accounts for gravevards on the summits of mountains, as on Mt. Khwaja Amran in the GWAJA Pass, and in the TRIKH KURAM and PALKAI Passes miles away from habitations.* I was told that parties on the road to and from a burial place were never molested. MacGregort states with reference to the GHILZAIS that it is the custom of the country to throw a heap of stones over a murdered traveller and that the road leading from SHILGHAR to ZU'EMAT the frequency of these heaps is sickening, in many cases being found at the closed ends of ravines, showing that the poor travellers have run as far as possible and then been hewed down. The same remarks would be perfectly true of the long and narrow TOPOBARGH Valley near Mt. MAZHWÖ in the highlands separating the country of the ZAKHPE'LS and Pánízais, a place particularly favourable for such murders, and the large number of such heaps as above described, sometimes three or four together, is horrible to contemplate. This method of forming cairns is common also in the Himalayan Districts, and I have seen Gurkhás in passing these Pathán cairns throw stones on them from sheer habit.

The Lu'nis form little pillars of rough stones to mark the spots of victories over the Belúchis, and several such pillars (fig. 16) are to be found in the Han Pass and about the Debatable Lands.

As might have been anticipated, of historical remains there are practically none. Indeed such could hardly be expected in a country which has no history to speak of, beyond petty internal squabbling, and no means of constructing buildings on any scale or of durable materials. In the Pishin there is an old ruined fort of the Háru'ns (Taríns) on a hill called Sire Khila deserted about 60 years ago; and near Samálzai, not far from Khu'shdil Khán, a small artificial mound with some fortifications on it like those at Quetta, with which it has probably a similar origin. It is called Srín Khila (White Fort) but has apparently no local history. The only distinctly historical traditions which the Kákars appear to have relate to Nádie Sháh's time, i. e., only a century back, and in the Bo'rai all

[•] The Zakka Khe'ls, a wild troublesome tribe about the Khaibar, who have a bad name, are said to have stolen a saint from the Yu'surzais and murdered him to obtain the Pi's round whose grave they bury their dead. Tradition says that they are such scoundrels, that no man among them could be found whom even they could reverence after death as a saint.

[†] Quoted above in the section on Polity.

remains are locally referred to him. In the centre of the Valley a fort of some size built on the same principle as that at Quetta, but not so high and much more extensive, is called Shahb-I-Nádb. It is now deserted and considerably ruined. The principle on which these forts were built is a very sound one in such a country, as the most desirable position from which to watch a valley is from an eminence so situated that all parts of the valley are visible at once, and at the same time that an enemy advancing from the hills must show himself. As it is very seldom that such eminences are natural they had to be constructed where necessary. This is the governing principle in the selection of the sites of Quetta and Kandahár, in fact the attempt to build Kandahár alongside one of the apparently strongly situated hills near it failed as a military measure.

In the Bo'rai Valley and along the route thence, viá the Hanumbár, Tríkh Kuram and Han Passes, towards Bárkho'm a remarkable set of remains are found everywhere in the shape of large quantities of pieces of burnt bricks and pottery* of a manufacture and excellence not now known in these parts. These are found in all kinds of places, on the hill tops, in the valleys and passes and alongside streams. The inhabitants say they are the remains of Nádir Sháh's army, but as this was an old Káfila route, the present one viá Mekhtar being not far distant, it is as likely that the presence of the remains is due to this as to Nádir Sháh's march in this direction; it is, however, more than likely that he and his successor Ahmad Sháh, the first Duráni and hero of Pánípat, or portions of their forces made more than one march along this route.

The state of civilization varies considerably with the locality, the inhabitants of the valleys being of course more civilized than their hill neighbours. As has been above observed, the more hilly the country the more scarce and rough the dwellings become, a sure indication of the general civilization of the occupants. The ZARKHANS and among the KA-KARS the DUMARS, ZAKHPE'LS, PANIZAIS and AMAND KHE'LS bear off the palm for wildness, and their civilization is merely nominal. The UTMÁN and SANDAR KHE'LS present a substantial, though rude, form of civilization of the patriarchal type, as shown in their buildings, their husbandry, their better class of wearing apparel and the quantity of food supply, much of it foreign, which they possess, and the same is true of the LU'NI KHE'LS. The Kakars of the Do'r and Gwal Valleys resemble their Pishin neighbours in almost everything, even to their habit of visiting foreign countries, and many an I'sá Khe'l or Shamozai Kákar is to be found, who has been in Karáchi and Bombay and even served as a sailor. In the Pishin there are many indications of a superior civilization, notably in the presence of

[•] Several specimens were sent to this Society by the present writer with the Geological collection he made in the districts under discussion.

women and children in the villages passed by the army, the knowledge of Hindústání, which is there so frequent as to carry one anywhere through the valley, and the travelling habits of the people. These traits are more specially to be observed among the Pishin Sayads, than among the Tarins, though many of these speak Hindústání fluently, as also can some of the Do'r and Gwál Valley Kákars. Many of the so-called Patháns who travel to all parts of India and even to Burmah selling horses are Pishin Sayads, some of whom make it a yearly practice to do so, keeping regular agents at Bangalu'r (in Maisu'r) and other horse marts. When the field telegraph was first opened at Gullstán Káre'z in the Pishin, all private messages had to be countersigned by the Political Agent, whose tent was besieged by applications for telegrams from the Sayads and Tarins, who sent messages to all parts of India, one being addressed to Kandy in Ceylon.

VI. Language.

My observations under this head were the most unsatisfactory of all, as I was enabled to do little more than observe the variations in the pronunciation of place names.

The language spoken is PUSHTO* in dialects not, however, differing so much from the standard Pushto of our army as to prevent the soldiers from being readily understood. Its most prominent feature, the excessive gutturalness, seen in such words as GHWAZH, UKHMUGHDAI, ZHIZHA TANGAI, is apparently such as is commonly to be found in the language, as also are the harsh cerebral t, d and r, so frequently heard all along the route.†

The next most important feature for the purposes of this paper is the interchange of consonants in place names. Those that came under observation are the following, some of which are doubtless due to local dialectic variation.

Changes of J.

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into d and z. Ngándeh = Ngánjeh: Syájgai = Syádgai = Sázdai.

into zh and y. ZHO'B = JO'B = YO'B.

into z. Zai (the termination) = Zo'i = Jai - Ji.

into sh. Khúshlák - Khujlák.

- Or Purhto. RH (2) and SH (2) are convertible sounds in the language.
- † This is especially the case in the Bo'sai Valley and in the country approaching the Beléch Border. But this might be due to the propinquity of the Beléchhi dialects in which t and d are very hard.
- ‡ All such interchanges are valuable for comparing and identifying the names given by various authors to places along the same route.

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into ch. KHUNCHAGAI = KHUNJAGAI.

Changes of Z.

into d. Dargai = Zargai: Manzakai = Mundakai: Sandar Khe'l = Sanzar Khe'l,

into d. To'B KHAIZE' = To'B KHAIDE'.

into zh. Zawar = Zhawar : Zadún = Zhadún.

into q. Mulázai = Malagai.

Changes of R and R.

r into r. Bo'rai = Bo'rai : Wariagai = Wariagai.

r and r into l. Múltat = Murtat : Kala = Kire' = Kile':
Shnagál = Shnaghar = Shnaghál.

r into d. KHWARA = KHWADA.

r into zh. Kizhdai = Kirdai.

Changes of D.

into g. Angánd = Ngáng = Nigánd : Syájgai = Syájdai.

Changes of G.

into k. Ko'T = Go'T.

into gh. Shnagal — Shnaghal: Ghwand — Gund: Ghundamarai — Gundamarai.

into kh. Gwája = Khwája.

Changes of KH.

into k. Ksho'i Káre'z = Khsho'i Káre'z.

into gh. IGHBARG = IKHBARG.

Changes of F.

into v and b. Isaf = Isab = Isav.

Changes of B.

into p. ALAB = ALIP.

Changes of S.

into sh. LASTAI == LASHTAI.

Changes of TS.

into ch. TSAMAULANG = CHAMÁLANG.

Changes of V.

into w. VATA'KRI = WATA'KARI.

Instances of the loss and addition of consonants are:

of G. Pla'ngzhara = Pla'nzhara.

of D and G. ANGA'ND = NIGA'N = NGA'NG.

of R. Dumar = Duma': Bagha'wa = Baghawar.

of K. LASHTAI = LASHTKAI.

And instances of the transposition of syllables and consonants are:

of R. SURGHWAND = SRAGHA'ND.

of Gh. Ghobargai = Oghbargai: Zaghlún = Ghazlún.

of N. Anga'nd = Niga'nd = Inga'nd.

From the above examples it will be observed that the most unstable consonants are J, Z, ZH, B, D, G, KH, F, B, S, TS, and v, with their counterparts SH, CH, ZH, K, GH, B, and W.

Regarding consonantal interchanges peculiar to the Pushto language, Raverty (Gram. Pushto, p. 3) has noticed that kh (¿) is changed into sh (¿), g (٤) into zh (¿), ts and dz into ch and j. And of the Khalbars he observes that they so transpose their letters as to be almost unintelligible. In his Dict. of Pushto (xxii) he further notices the interchange of z into dz.

Of vowel sounds I noticed as peculiar an o pronounced in several words as the close German ö, thus, Uzhdö, Ma'zhwö. And also the common termination ai (written by Raverty aey) which is sounded with a closed mouth and sharply as one syllable, though it partakes of the nature of two; thus, ai. The frequent recurrence of this last gives the language an uncouth sound, and, coupled with the prevalence of guttural consonants, an unpleasant harshness to English ears.

The vowel changes are not important, the following being the most noticeable.

Changes of A and A'.

a into i. Angánd = Ingánd: Kazhdai = Kizhdai: Kala = Kile' = Kire': Tsamaulang = Chimálang: Alab = Klip.

· a into u. Mulázai = Malagai: Manzakai = Mundakai.

a and á into au. Tsamaulang = Chimalang = Chimálang.

Changes of AI.

into i and o'i. Zai = Zo'i = Zí: Lákai = Lákí: Bo'rai = Bo'rí: Lúnai = Lúní: Dargai = Dargí.

into a. MANGAL = MAINGAL.

Changes of U.

into o. Lúnai = Lo'nai.

Changes of I.

into e. I'SAF = E'SAF.

Changes of WA.

into au. Waria = Auria.

into u and au. Ghwand = Gund: Wariágai = Ubiágai = Aubiágai.

into á. Surghwand = Surghán.

into o. BAGHÁWA = BAGHÁO.

Among local peculiarities a tendency to shorten and nasalize long vowel syllables was frequently to be noticed, thus—

Anandún for Amadún: Adinzai for Adizai: Bánzai for Bázai: Ajjí Khán for Ḥa'jí Khán: Hanumbar — Anubar: Angánd and Ningánd — NIGA'N: BAHGA'WA == BAGHAWAE: and numerous other instances could be adduced.

The Persian silent w Raverty (Gram. Pushto 4) observes is always sounded in Pushto; thus is pronounced Khwa's, not Kha's. My observations in Kákar-land did not quite bear him out in this; for the following I found to be aynonymous pronunciations. Akhund and Akhwand: Zarkha'n and Zwarkha'n: Surkhwa's and Surkha's, (where the w is a gratuitous insertion, the word being Surkh + a's, red water): Surghwand and Surgha's.

Before leaving the vowels a curious insertion of Y in the following word is worthy of remark. Cho'tla'll is locally Cho'ta'lal: Zakhpe'l and Zakhpye'l are synonymous and so are Sya'jgal and Sa'zgal.

The following is a list of the various forms under which place names were found by myself and on which the foregoing observations are based.

- 1. Anga'nd = Nga'njeh, Niga'njeh, Niga'n, Ingan, Ninga'n, Nga'ng, Niga'nd, Angand, Nga'ndek.*
- 2. MUZARAI = MZARAI.
- 3. Ajjí Kha'n = Ha'jí Kha'n.
- 4. Gwa'ja = Khwa'ja.
- 5. SKAN = ISKAN.
- 6. Zai = Jai, Jí, Zo'i.†
- 7. $Z_{HO'B} = J_{O'B}, Y_{O'B}$.
- 8. I'saf Kach I'sab Kach, E'sab Kach, E'saf Kach, Yosuf Kach.
- 9. KHARZANGAI = KHABARZANGAI.
- 10. Alla'hda'd = Kha'lakda'd.
- 11. Khúshla'k = Khujla'k.
- 12. KIZHDAI = KIRDAI, KAZHDAI, KIZHDI.
- 13. KALA = KILE', KIRE', KO'R.
- Surkhwa'B = Surkha'B.
- 15. KHUNCHAGAI == KHUNJAGAI.
- 16. $Go'_T = Ko'_{T,\parallel}$
- 17. Khsho'í Ka're'z = Ksho'í Ka're'z.
- Jen is for Den, a village. These words represent the Lon Angang and Koz Angang of the map (Do'r Valley).
 - † To show pronunciations of ai: this is a termination not a word.
- ‡ These names arise from the confusion between Isav and Yosur (Keau and Joseph).
- These words have the same meaning, viz. God-given: there is a similarly named village near Kandahár.
 - These are not place names.

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- 18. ZHAWAR = ZAWAR.
- 19. IGHBARG = IKHBARG.
- 20. Amadún = Amandún.
- 21. Adigai = Adingal.
- 22. ZADÚN = ZHADÚN.
- 23. MANGAL = MAINGAL.
- 24. BA'ZAI = BA'NZAL
- 25. Surghwand = Surgha'n, Surgha'nd, Sragha'nd, Surghan, Surghand.
- 26. Shnaga'l = Shnaghar, Shnaghal, Shnagai, Shna' Khorai.
- 27. Waría Kach = Auría Kach.
- 28. WARGAI = BARGAL
- 29. MULA'ZAI = MALAGAL
- 30. ZAKHPE'L = ZAKHPYE'L = ZAKHWAI.
- 31. GHOBARGAI = OGHBARGAI.
- 32. DUMAR = DUMA'.
- 33. Sya'jgai = Sya'dgi, Sya'dgai, Sa'zai, Sya'jdai, Sazdai.
- 34. KHWA'RA = KHWA'DA, KHWA'R.
- 85. Zaghlún = Ghazla'na, Ghazlún.
- 86. DARGAI = ZARGAI, DARGÍ.
- 37. GHUNDAMARAI = GUNDAMARAI.
- 38. GHWAND = GUND.
- 39. PLA'NEHARA = PLA'NGEHARA.
- 40. SURMASTAILI = SURMASTA'LL.
- 41. BAIA'NAI = BIA'NÍ.
- 42. SANDAR KHE'L = SANZAR KHE'L.
- 43. To'r Khaize' = To'r Khaide'.
- 44. Cho'tia'li = Cho'ta'lai.
- 45. BO'RI = BO'RAI. BO'RAI.
- 46. Lashtai = Lastai, Lashtkai.
- 47. Waria'gai = Waria'gai, Uria'gai, Auria'gai.
- 48. HANUMBA'R = ANUBA'B, ANUMBA'B, HANUBA'R.
- 49. MULTAT = MURTAT.
- 50. LÚNI = LO'NAI, LÚNAI.
- 51. La'kar = La'kí.
- 52. TSAMAULANG CHIMALANG, CHAMAULANG, CHAMAULANG, CHAMAULANG, CHAMALANG,
- 58. ALAB = KLIP.
- 54. SOBA'H = SOBA'T.
- 55. BAGHA'WA = BAGHA'O, BAGHAWWA'R.
- 56. VATA'KRI = WATA'KARI.
- 57. Zarkha'n = Zwarkhán.

- 58. To'r Tsappar = To'r Tsuppri.*
- 59. PASTE' = PASTO'.
- 60. MANZAKAI = MUNDAKAI.

The frequent recurrence of certain names on the map leads to the supposition that many of them are merely descriptive and on examination the meanings of a great portion become apparent, the descriptive words having changed very little on becoming names of places. † And though it is always treading on dangerous ground to give derivations of place names, I think the following are worth hazarding:

- 1. TANGAI means a gorge or pass, so Spir Tangai would be the White Gorge (Spir for Spin) and Túr Tangai the Black Gorge (Túr for To'r.)
- 2. GHUND is round, globular and the GHUND Peak would mean the Round Hill, and Mt. SURGHWAND the Red Round Hill. Again GHUNDA is a detached hill and GHUNDAMARAI is Adam's apple in the throat, and as applied to a village would mean the village by the round detached hill.
- 3. Lwa'ra means hilly and as applied to a valley would signify the hilly or upland valley.
- 4. Chor means a ravine or water furrow and is applied to a steep-banked stream in the Pishin.
- 5. Sire' Khila would be the Inn or Caravanserai Fort. It was the old rendezvous of the Hárún Taríns in the Pishin. This is probably also the meaning of Zara Khila in the Pishin.
- 6. The Gaz Hills might mean the Long Hills from گز a yard-measure or the Tamarisk Hills from غز a tamarisk.
- 7. MZARAI means a particular kind of reed and is applied to a river, a valley, and some marshy springs and the hills near these last.
 - 8. SURKHA'B is the Red River.
- 9. Zarghún means green, verdant, fresh and is applied to a range of mountains covered with forest in the heights and to a village by a stream.
- 10. Lúz means Upper and Kúz, Lower, when found in composition with place-names. Lo'we' and Lo' mean Greater: Kuchnai and Kaun, Lesser.
- 11. In MEHTARZAI, MEHTAR is Persian meaning "master, ruler." MEHTARZAI would mean the Ruling Clan.
- 12. Ghwazh means a sluice and also the ear, and is found applied to a stream and a range of the hills, the Spin Ghwazh, (?) the White Ear Hills. Zhwazh means the murmuring of a brook and may be the deriva-
- A corruption of Kálí Chuppeí the Belôch name for the same place with the same meaning, viz., Black Rock. Thus Trikh Kuram is called also So'h Kuram, which has the same meaning, Salt Springs.
- † I do not here refer to such purely men's names as Habíbullah, Khúshdil Khán, transferred to the villages owned by the persons of these names.

tion of the river name, whence perhaps also ZHIZHA TANGAI (?) the Rippling Pass.

- 13. Mt. KAND may derive its name from KAND a chasm or KANDAI broken ground.
 - 14. Mt. PfL from its fancied resemblance to an elephant, PfL or FfL.
- 15. SHARAN KA'RE Z and SHARAN occurring two or three times and once as SHE'RÍN, are probably for SHÍRI'N, sweet.
- 16. SUB OF SUBAL is red and is met with in several words. SUBAL also means a passage and the so-called SUBANA'BI Pass (the SUBAL Pass of my maps) is for SUBAL NARAL, the Slender Passage. Cf. also LA'NDAL SUBAL (?) the Lower Passage. MO'MAND SABA'I (?) the Momand's Passage.
- 17. The word GHBARG, as in OGHBARG, IKHBARG, IHGBARG and in the plural forms GHOBARGAI and OGHBARGAI, occurs several times. It means the flat land between two hills, and upland valley: also double, two, twins. In which latter sense it is probably used when applied to hills. And hence also NARAIGHBARG Hills may mean the Narrow Valley Hills.
 - 18. Ro'd means merely a river: Ro'dBA'R, a valley stream.
- 19. Kshai means in, between, etc. and Ksho'i Karez might mean the Middle Káréz.
- 20. Khwara is probably for Khwara, a sandy stream-bed, as several such beds debouche into the Shor valley at the spots so named.
- 21. SAGAR, SRAGHAR, SARGHAR, SURGHAR all common names mean the Red Hills (SUR+GHAR). So the SAGARBAND Pass would be the Red Hills Pass.
 - 22. SURKAI ZANGAL is the Red Forest.
- 23. DARGAI, a very common name, is the plural of DARGA, a copse, a place where trees and brush-wood grow together. DARGA also means a shrine and this may account for its application to villages.
- 24. Gurkhai is applied to a mountain stream and its defile and may mean rattling, noisy, as Garkai is the rolling of a carriage and Garkanpa a rolling stone from a mountain.
- 25. ZAWAR or ZHAWAR (ZAWAR) is a slope, declivity. LWAR ZWAR is uneven ground. ZHAWAR also means a deep or hollow place.
- 26. Ush or Ukh is the camel. The Ush Pass means the Camel's Pass, and the Ukhmughdai Pass the Camel's Mouth Pass. (Ukh+Makh).
- 27. Uzhoö, the name of a peak, is apparently the plural of Uzho, Uzho and Uko, long, lengthy, stretched out.
 - 28. Tsa'RU Peak = ? the Look-out Peak.
- 29. The Mo'sai Pass may derive its name from Mo'sai, a child's marble, a round stone, or from Mo'zi', troublesome.
- 30. Kach is the cultivation by a stream-bed and is seen not only by itself as a name for a stream, a village and a hill, but constantly in compo-

sition, as I'saf Kach, Esau's Plot, Ta'zı' Kach, Greyhound Plot, Ko'sh Kach, Crooked Plot, Waria Kach, the Free Plot, Súr Kach, the Red Plot, Zagan Kach (?) the Rough Plot.

- 31. Sho'E which constantly appears as a name is probably for Sho'EA or Kho'EA, saltpetre, nitre: a common property of the soil along the route. It appears again in So'E Kúram, the Salt Springs.
- 32. SHNA' KHORAI occuring as a synonym for SHNAGHA'L, a village name, would mean a Mastic Eater.
- 83. TRI'KH is salt, bitter, and appears in TRIKHA'DAGH, the Salt Hill-side, if DA'GH is for TA'K, or the Salt Plain, if DA'GH is for DA'G: and in TRI'KH KURAM, the Salt Springs.
- 84. CHAPPAR or TSAPPAR, a corruption of Hind. CHAPPAR a thatched roof appears as a hill name in Mt. CHAPPAR and in To'R TSAPPAR, the Black Roof, a hill in the Han Pass. Both peaks have rounded tops. It is worth mentioning here that TSAPA means a wave, billow.
- 35. CHI'NAI is a common village name and is the plural of CHI'NA, a spring, fountain.
- 36. GHAR, a hill, appears in Mt. SPINSKHAR, the White Hill: SPE'RAGHAR Hills, the Grey Hills: TANG GHAR, the Narrow Hills. ZHAR, appearing in several hill names, is probably for GHAR: ZHARPITAU Peak, the Sunny Peak, PLA'NZHARA Hills, the Broad Hills; ZHARUBAND Peak, Hills End, is given to the last hill of a line in the SHO'R Valley.
- 37. ISPIRA RA'GHA, the Open Meadow (SPARAI + RA'GH); the place is an open spot near Mt. Ma'zhwö. SPARAI, open, also turns up once or twice as SAPURAI.
 - 38. Mt. SURLO'(?) the Red Tablet.
 - 39. TANG To'r Peak, the Narrow Black Peak.
 - 40. SURTAK Peak, the Red Precipice.
 - 41. Male'wa Peak (?) The Camel Sack (Malav).
 - 42. La'ndai Peak, the Lower Peak.
 - 43. PLA'N Springs, the Wide Springs.
 - 44. Khúní Hills, the Bloody Hills.
- 45. Shaka're'z (?) The Back Káréz and Jalka're'z, the Thorn Káréz; two villages near each other in the Bo'rai valley. Shaka're'z occurs twice.
 - 46. Kutsa or Kucha Valley means perhaps the Little Valley.
- 47. TSA'HAN Wells. TSA'HAN is the plural of TSA', a well, pit. The word appears again as UCHSAHA'N Springs. (?) The Upper (új) Springs.
 - 48. BA'GHU TO'R Peak (?) The Black Bogie. BA'GÚ is a bugbear, bogic.
 - 49. Ва'la Dha'ка (?) The Upper Plain (ра'с).
- 50. Hanokai is probably a diminutive of Han, the two passes being near each other.
 - 51. Toghai, a river name, is Turkí for a reedy plain.

In a former paper in this Journal* I remarked that a village may be called by six different names by guides, those thoroughly acquainted with the locality would recognise it by any one of them, others less well acquainted will only know it by some of them. Thus a village may be called (1) after the district or tract of land in which it is situated. TAKHT-I-PUL is such a name, MEL MANDA is another; villages 10 miles apart are called TAKHT-I-FL and MEL MANDA simply because they are situated in the tracts so called. (2) It may be called after the section of the tribe which inhabits it, thus, BA'BAKZAI; (3) after the subdivision, thus, KHUNSE'ZAI or MOHAMMADZAI, (4) after its late owner if recently dead, (5) after its present owner, thus, Kala-i-núr-ud-di'n Kha'n merely means Núr-ud-di'n KHÁN'S village, and the owner's is usually the proper name of a village, (6) after its own name. To give an example; the village marked AMI'N KALA in my map of the Arghisa'n valley was named to me as BABARZAI, MUHAMMADZAI, AMI'N KHAN and LATI'F KHA'N. LATI'F KHA'N is its present owner: AMI'N KHAN was the late owner, MUHAMMADZAI is the subdivision and BARAKZAI the section of the tribe inhabiting it. It will be easily seen that the more general terms are known at a distance and the more specific ones only in the immediate neighbourhood of a village. Complicated as this system of nomenclature looks, it is natural enough in a country where the individual occupies such an important place in men's minds and nationality so little. It is not difficult to deal with in practice, after a slight knowledge of the country is acquired, but it accounts for the great apparent discrepancy in names and distances met with on maps and in routes. These remarks are true also of the TARI'N and KAMAR country. Thus in the PISHIN, GANGALEAI and SHASHDA'D are names for the same place, and so are URUMZAI and SAYAD SA'LO and also BRIJA'N KALA and AULI'A KALA. Several villages are called BRAHAMEAI, viz., SAYAD Do'st MOHAMMAD, SAVAD KHAMA'NDAI, SAVAD LA'L. Three are called Lob (Upper) KHA'NIZAI, viz., MOHAMMAD SA'DIK, VAKI'L, and LA'L MOHAMMAD and two BAGARZAI, viz., SAYAD ALAB and SAYAD PAIYO; two YA'SINGZAI. siz., SAYAD SHE'RBAT and SAYAD TO'TI. The more specific are the malik's (or owner's) names. In the case of the BRAHAMZAI villages, that of Do'sT MONAMMAD may be called BRAHAMZAI proper, and the same is to be ebserved of the three Ka'kozai villages in the same neighbourhood, one is called KA'KOZAI and the other two also MADAT and ATA' MOHAMMAD. On entering the Do'r valley the two villages known in the Pishin by several variations of the word ANGA'NG or NINGA'ND are found to be locally Lorand Kuz Angang, Upper and Lower Angaing. Names, however, are more specific in the Do'r, and villages of the same name are distinguished by the tribal name in addition, thus TLARAI (ISA KHE'L) and

Rough notes on the Distribution of the Afghán Tribes ahous Kandahár. Vol. XLVIII, pt. I, 1879.

TLARAI (MEHTARZAI). In the Bo'rai valley, however, Wazia'gai and Khankai seem to be general names for groups of villages and we have two Múrs and two Waha'rs. In the wilder parts names become more general and merely descriptive, everything in the neighbourhood, valley, river, village and hills, all being known by the same name. Such are, O'bushtkai, Khwa'ra, Chimja'n, Kach, Bail'nai in the Sho'r valley, and in still wilder regions Nangalúna, To'pobargh, Tri'kh Kúram, Tsamaulang and Ba'la Dha'ka. Towards the Belóch Border double names, the Pathán and the Belóch are met with, as To'r Tsappar and Ka'li' Chuppri, both of the same meaning, the Black Hill: and Ba'han Kund (Pathán) = Bani'wa'la' Kach (Belóch).

Some names are corruptions and abbreviations; such as Sayad Sa'lo and Sa'yad A'tu probably, and perhaps Skan and Iskan for Alexander (Iskandar): Ajji' for Ḥa'ji': Sama'lzai for Isma'ilza'i: Brahamzai for Ibra'himzai: A'lip and Alab for Ḥalab (Aleppo): and perhaps Sopa'nzai for Isfaha'nzai.

In places there seems to be a tendency to call villages after the names of celebrated places, thus we have Di'lai, La'ho'r and Múltat in the Bo'rai valley.

Before leaving this point I would remark that across the Beloch Border in Ba'rkho'm (or Ba'rkha'n) a similar if not a greater confusion of nomenclature exists. Thus the place called Luga'ri Ba'rkha'n is also called Bangala': Hasni' Ko't = Ta'nkhi Shahr: Cha'hr'n = Ba'bul Kha'n ka Ko't or Shahr: Na'ndha' = She'kh Ko't while all the Na'har villages are sometimes grouped as Na'har Ko't, and finally the valley itself is variously called Ba'rkho'm, Ba'rkha'n, Luga'ri Barkha'n, Lúndi'a'n and Kaho.

Having now explained as far as possible the reasons why the nomenclature of travellers* along the same route in Afghanistán should differ so greatly, and in order to clear the way for future students of this particular route, I close this paper by a comparison and identification of names found in the journals of other travellers with those to be found in my maps. Included among these are the nomenclature in Capt. Holdich's plane-table sketch-map of the Route and in the Quarter Master General's Departmental sketch-map, and also the names given in Major Waterhouse's paper in this Journal.†

^{*} Capt. Heaviside remarks on the difficulty of obtaining Afghan names, in Major Waterhouse's report, pp. 53. J. A. S. B. Vol. XVIII, pt. II, 1879.

[†] The works referred to in the comparison are Notes on the Survey Operations in Afghanistán in connection with the Campaign of 1878-9 by Major Waterhouse, J. A. S. B. 1879. Mackenzie's Routes in Asia, Sec. II, Afghanistán. Macgregor's Gazetteer, Afghanistán, Leech's Route: Dera Gházi Khán to Kandahár. Lumsden's Mission to Kandahár. A more detailed identification of the names along the route will be found in the appendix to my paper in the J. R. G. S. above referred to.

KOT	Templo. Ma'r Pass	Madgregor.	Sundeman. Holdiod M. Holdiod		Q. 1K. G.	Waterhouse.
DAKKU KO T		I'BA'N1'	;	# 7 m	MA'B	:
KA'LA CHAPB	A'RKHA'N)	DAKKU KOT KA'LA CHAPBY'		DAKKU KHA'N		: :
Hankey Sab	UPPRI' }	KA'LA CHAPB	:	:	:	;
KUCHA CHORAM TREEK KURAM TREEH KURAM PAINDEH KHA'N KOT' PAINDEH KHA'N KOT' INTEREM KURAM INTEREM KURAM PAINDEH KHA'N KOT' INTEREM KURAM INTEREM KURAM INTEREM KURAM PAINDEH KHA'N KOT' INTEREM KURAM INTEREM KURAM INTEREM KURAM LÚNI PAINDEH KHA'N KOT' INTEREM KURAM INTEREM KURAM LÚNI PAINDEH KHA'N KOT' INTEREM KURAM INTEREM KURAM BA'IA DA'KA BA'IA DA'KA BA'IA DA'KA BA'IA DA'KA JA'NDRA'N JA'NDRA'N JA'NDRA'N JA'NDRA'N BA'BKHA'N INTEREM KURAM INTEREM KURAM INTEREM KURAM BA'BKHA'N INTEREM KURAM INTEREM KURAM INTEREM KURAM	Pass	HANKI' SAB	:	HANNOKAI	HAMMATOT	T
So'r Kuram Treek Kuram Treeh Kuram Treeh Kuram Paindeh Kha'n Kot' Paindeh Kha'n Luni Paindeh Kha'n Luni Paindeh Kha'n Kot' Lúni Paindeh Kha'n Kot' Ba'ia Dha'ka Ba'ia Da'ka Dhowlah Dhowlah Dhowlah Dhowlah Dhowlah Dhowlah Chama'iang Chama'iang Ba'ia ha'n Ba	lley	Кисна	:		TOWN	HARUKAI.
PAINDEH KHA'N KOT' PAINDEH KHA'N KOT PAINDEH KHA'N KOT LÚNI PAINDEH SHAHB BA'LA DA'KA BA'LA DA'KA BA'LA DA'KA CHO'B RÍ TAP JA'NDRA'N JA'NDRA'N JA'NDRA'N JA'NDRA'N JA'NDRA'N DHOWLA DHOWLA	URAM	So'r Kuram	: :	TREET Kms.w	T	: :
PAINDEH KHÁN SHARB .	<u> </u>	PAINDEH KHA'N KOT' PAINDEH KHA'N LIDA			THEFT DORAM	TRIKH KURAM.
Lúni Paindeh Shahb Ba'la Dha'ka Ba'la Da'ka Ba'la Da'ka Ba'la Da'ka Ba'la Da'ka Ba'la Da'ka Cho'b Trap Ja'ndra'n	IA'N Ko't	Рагирен Кная Shahr Рагирен Кна'м Ко'т	i	:	:	;
Ba'la Da'ka Ba'la Da'ka Ba'la Da'ka Ba'la Da'ka Cho'b Teap Ja'ndra'n Ja'ndra'n Ja'ndra'n Ja'ndra'n Ja'ndra'n Ba'ra'lang Chama'lang Cho'b kf Tap Ja'ndra'n Ja'ndra'n Ba'ra'lang Chama'lang Ba'ra'lang Ba'ra'lang Ba'ra'lang Ba'ra'lang Ba'ra'lang Ba'ra'lang Ba'ra'lang Ba'ra'lang Ba'ra'lang Ba'ra'lang Ba'ra'lang Ba'ra'lang Ba'ra'lang Ba'ra'lang Ba'ra'lang Ba'ra'lang Ba'ra'lang		Lúni Paindeh Shahr				
CHO'R TRAP GHO'R KÍ TAP JA'NDRA'N DHA'OLA R. KA'HA CHUMA'LANG R. LA'KÍ LAHAB CHAMA'LANG CHAMA'LANG CHAMA'LANG CHAMA'LANG CHAMA'LANG BA'RKHA'N BA'RKHA'N BA'RKHA'N BA'RKHA'N BA'RKHA'N BA'RKHA'N	A'KA }		A Ba'ea Dha'ea	Ba'la Da'ka	Ba'la Da'ka	Ba'rra Da' r a
Ва/вкна'м Ја'мрва'м Ја'мрва'м Ва'вкна'м Оноwia Ја'мрва'м Ва'вкна'м Оноwia Оноwiaн Ва'вкна'м Онама'iang Онама'iang Ва'вкна'м Ва'вкна'м Ва'вкна'м	AP V Hills	CHO'B TRAP	:	:	CHO'R KÍ TAP	
В. Та'кі Ганав Ва'вкна'я Снама'ламу Ва'вкна'я Ва'вкна'я Ва'вкна'я Ва'вкна'я		DHA'OLA		JA'NDRA'N	JA'NDRA'N	: :
GHUMA'LANG		R KA'HA	:	DHOWLA	DHOWLAH	:
B. La'rí Lahab Ba'brha'n Ba'brha'n Ba'rhh'n	МĢ	CHUMA'LANG	: :	CHAMA'LANG	CHAMA'T.AWG	
BA'BEHA'N BA'EKHA'N BA'BEHA'N BA'RHA'N	,	В. La'кі Lahab	:	;		OHAMA MANG.
	~ ~		Ва'вкна'я	Ва'якна'я	ВА'якна'я	 Ba'nerra'y

Waterhouse.	:	:	:	:	:		Waterhouse.	Jac (, 1 m., 0 m.)	10 TIA LL	:	THAL.	Вкиг.	Ваена'0.	SMALAN.	:	Saga'we.
Q. M. G.	HAN KU'A	BA'HANWA'LA'KA'CH	:	:	•		Q. M. G.		V.T.T.		Thur. Th	REHI R.				Sanja'wi Si
Holdich.	Най Коа	•	•	:	:	Neighboushood	Holdich.	,,	CHOTIATI	Ko'lu	Told .	Ка'на	Ванна	SMALAN	SHINLAZE	Singa'wi
Sandeman.	:	:	:	:	•	TI M. Ol. 18:17; and Weightonshood	Sandeman.		CHO'TA'LI	Ко'ги	THAL	i	:	:	SHINJA'ZAI	Shinja'yi
Macgregor.	MITA KOH	BA'HANWA'LA' KACH	BABBO'J BABBO'Z Brano'z	Ваена о	P Shinghar P Sanghai	F	Mannagen	Track of the	Сно'та'ы	Koʻlu	THAL	Ва'н Ва'нт }	Ваена'0	SMALAN	•	:
			<u>~</u>	,								~	,			
Temple.	Mirthí Khóín	Ва'нам Кимо	Barbúz Hills	Вавна'о	Sraghar (Lóm Valley)		Tomalo	ordina t	CHO'TIA'LI	Ko'lu	TAL	Ва'на	BAGHA'WA	SMALAN	SHINLE'Z	Sinza'vai

18	880.]	R.	C. 7	l'en	ple—	-Ro	ut	s 0)	f ti	ho 1	Tal C	Thoti	iali Fi	eld	Fo	ros.		175
	Waterhouse.	Во'ял.	ANAMBA'B.	:	Ninga'n.	:	:	:	:	:		Waterhouse.	:	;	CHIMJA'N.	:	:	:
	Q. M. G.			:		DKAI	:	:	:	:		Q. M. G.	DARGAI	CHINA'LI	CHINJA'N	:	:	SURKHA'B
bood.		Bo'aı	ANAMBA'B		Ninga'n	BA'MEMAI					y.	Holdiob.	Dabbai	CHINA'LI	Снімла'я	:	:	SURKHA'B
d Neighbour	Leech	Bo'rı	:	:	•	:	:	:	:	:	Pishin Valle	Lumsden.	Darga'r	:	CHINJA'N		:	: P2
IIIBoras Valley and Neighbourhood.	Holdich.	Вно'вп	ANUMBA'B	:	Nimga'n	BARNEMAI	:	:	:	SHABOZAI	IV.—Shór Valley to Pishin Valley.	Leech.	:	:	CHINJA'N	:	P SAZAN	SUBKHA'B Ford
III.—B		}	Ā		Σ̈́ Χ΄ ~~	B.		,	•	SE	IV.—S	Sandeman.	:	:	:	:	:	:
	Macgregor.	Bo'ra Bo'ri	ANABA'B	ME'KHTAB	NIGA'NDH INGA'D	BARNAMAI	? MENA	P Gwa'l	LOORALAIR	SHAMBOZAI		Macgregor.	Dargai }	P CHENA'TI	:	CHAPR CHAPRÍ S	:	:
	Temple.	Bo'ra Valley Bo'ra	R. HAHUMBA'B \	MEKHTAB	NINGA'ND {	BARMINAI	ME'ND Pass	NAIGWA'L	R. Lo'RALAI	SHABOZAI		Temple.	DARGAI (SHO'R Valley)		CHIMIN'N	MT. CHAPAR }	ZAGAN KACH	R. Surkha'b (Do'r Valley)

Temple. Kach	. Масј Р Катеан	. Macgregor.	Sandeman.	Holdich.	KATS		Waterhouse.
1	LANTAR	:	:	:	11470	:	:
DUMAR	Витжар	;	:	:	DUMAR	:	:
SP E'ZHANDAI	:	SPINZANDAI	:	:	SPEZANDAI	SPE'ZANDAI	:
FRAF KACH {	YU'SAF KACH ISAB KACH	ISAB KACH	:	•	YU'SUF KAG	Yu'sup Kach Yu'sap Kach Eusap Karch.	EUSAF KATCH.
NINGA'ND }	:	NAGA'ND	:	:	Анда'ир	Ninga'nd	Ninga'n.
Ka'kar	Ка'кав	KA'KAB	Ka'kub		KA'KUB	KA'KUB	Ка'кав.
Temple,	Macgregor.	Sandeman,	Holdich.	Leech.	Lumsden.	Q. M. G.	Waterhouse.
AMAND KHE'L	SANATYA	:	:	:	STMANTHA	:	:
Вна'нда'р	:	:	:	:	Вна'нда'р	:	:
Kala-i-Abdulla- Kha'n	:	:	Кпа Аврила	477	:	KILA ABDUL. LA KHA'N	KILA ABDUL. KILA ABDUL. LA KHA'N LA.
PISHIN	PE'sufn	PE'snfn	PISHIN	Pgshfr	PE'sufa	PESHIN	Рівній.
Кно'лак	Кно'лак	Кно'лак	Кно'лак	Конлак	:	Ko'jak	Кно'лак.
Вавяно'я	Вавяно'ва	:	:	BARSHO'R	:	:	:
SAYAD PAIND	PAIN KALA		SAIPA'N SAIPAIN	•	•	Saip a'n	:

A comparison of the names to be found on the three latest maps of this route, namely, those of my own, Capt. Holdich, and the Quarter-Master General's Department, will complete my observations.

From the Pishin eastwords.

	rom the Lishin eastu	varas.
Temple.	Holdich.	Quarter-Master General.
Kadanei Valley	Kadanai	Kadanei.
Kho'ja Amra'n Hills	Kho'ja Amra'n	Kho'jeh Amra'n.
Khwa'ja Amran Peak	Kwa'ja Amran	***
Kala Abdullah Kha'n	KILLA ABDULA	KILA ABDULA KHA'N.
Gwa'ja Pass	Gwa'ja	Gwaja.
TANGAI	Tangí	• • •
Kho'jak Pass	Kho'jak	Koʻjak.
Arambi	Arumbi	Arumbi.
Rahamdil Kha'n	Ra'mdil Kha'n	***
Badwa'n	Budwa'n	Badwa'n.
Turkhe'l	Turkhe'l	TURKHAIL.
Brija'n Kala	Maisai & Paizí	•••
SAYAD SALO URUMZAI	Uramzai	•••
SHA'HDA'D GANGALZAI	Gangalzai	***
Ajabzai	Ajabzai	Ajabzai.
Sayawzai	Se'mzai	Se'mzai.
<i>A</i> LÍZAI	ALAZAI	Ali'zai.
R. To'ghai	To'ghai	•••
R. MUZARAI	MUZARAI	•••
SOPA'NZAI	Ze'rı'	. •••
	{ Brahamzai } Brainzai	***
Ma'likai	Ma'lizai	•••
BAGARZAI	BAGGARZAI	Bagarzai.
Sama'lzai	Sma'lzai	Sma'lzai.
SAYAD PAIN	Saipa'n & Saipain	Saipa'n & Pain Kala.
Noa' Ba'za'r	•••	Noa' Ba'za'r.
Manzakai	Manzakai	Manzakai.
Kha'nizai	Kha'nzai	KHA'NZAI.
She'kha'lzai	Sheikha'ri	Sheikhaha'ri.
Khu'shdil Kha'n	KushdiL	KHUSHDIL.
R. Barso'	Barso	Barso'.
Ma'likya'r	Ma'likya'b	Ma'likya'r.

Temple.	Holdich.	Quarter-Master General.
Kama'lzai	Kama'lzai	Kama'lzai.
Nu'rzai	Na'ria'n	Na'ria'n.
Ya'singzai	A SIMZAI	Asimzai.
Tabi'n	Turi'n	Turi'n.
SURAI Pass	Surina'ri	SURUNA'RI.
Anga'ng	Anga'nd	Ninga'nd.
R. Surkha'b	Surkha'b	Surkha'b.
Mohammad Sharfi	Saria'da Ka're'z	Sarea'da Ka're'z.
Mt. Kand	Kund	KAND.
MEHTARZAI	Me'trazai	ME'TRAZAI.
TLARAI	TALABAI	LARAI.
MURGHAI	Murgha'	Murgha'.
Sharan	Shiran	•••
Nari'n	•••	Nari'n.
Balozai Ka're'z	BALOZAI	Bulozai.
Sa'ghai	SARGAI	SARGAI.
Sama'wan	ZEMIRSTA'N	Zemirsta'n.
Kha'nizai Ka're'z	Kha'nzai	Kha'nzai.
Shakar	SAKKAR	Sakkar.
Zarghu'n Ka're'z	Zergu'n Ka're'z	•••
Ksho'i Káre'z	Kuso'i	Kuso'i.
R. Ro'd	To'gai	To'GAI.
Gwa'l	Gwa'l	Gwa'l.
Pishin	Pishin	Pe'shi'n.
Mt. Takatu'	TAKATU'	Ta'tucka.
WOCHAKHLA	TURA KALA	•••
UKHMUGHDAI Pass	OKHMUKHZAI	UCHMUCHZAI.
R. Zadu'n	•••	Zerdu'n.
Amadu'n	Amadu'n	Amadu'n.
Mt. Zarghu'n	Zerghu'n	Zerghu'n.
Ka'kar	Ka'kur.	Ka'kur.
I'SAF KACH	YUSUF KACH	YUSAF KACH.
USH PASS	Ushta'ra	Ushta'rah.
Mt. Mazhwö	Mashkwar	Mashkwar.
Spe'zhandai	Spe zandai	Spe'zandai.
Ispira Ragha	{SPIRABAGHA }	Spirara'ghah.
Mt. Spinskhar	•••	Spinskhar.
DUMAR	DUMAR	• • •
Mt. Surghwand	Surkand	Zergu'n.
Zно'в Valley	Z но'в	Zно'в.

Temple.	Holdich.	Quarter-Master General.
NANGALU'NA Pass)	7.0
Mo'mand Sara'i Mo'mand	Mo'mandgai	Mamanagi.
O'BUSHTKAI	/ О'воякої	O'boskol
CHIMJA'N	CHIMJA'N	Chinja'n.
Pa'lkai Pass	Pa'lki'	Pa'lki'.
WARGHAS	Wergus	I A HAI.
HINDU BA'GH	HINDU BA'GH	HINDOO BA'GH.
GURMAT	GURMI'	GURMI'.
Mr. Matkhilar	Mashkhilab	Mashkilar.
Mt. Sya'jgai	SIA'SGAI	Sia'sgai.
DARGAT	DARGAI	DARGAI.
CHINA'LI	CHINA'LI	CHINA'LI.
Surgalu'n	Shundlu'n	Shu'n Lu'n.
Ka'sat Hill	Mana'ra	Mana'ra'.
KACH	KATS	Kars.
Baia'nai	Bia'ni	Bia'ni.
SARKAI ZANGAL	Skaijangal	Skaljangal.
NINGA'ND	Nimga'n	Ninga'n.
GEOBARGAI Hill	Gobargi'	GOBARGI'.
Smalan	Smalan	Smalan.
SINZAWAI	Singa'vi	Sanja'vi.
Shinle'z	SINGLAZE	Singlazi.
Bagha'wa	Вадна'о	Bagha'o.
JALKA'RE'Z	Ka're'z	Ka're'z.
Shaka're'z	Shahka're'z	Shahka'be'z.
To'r Khaize' Hills	Durgainni Darmangarh	DURGUNNY.
Lashtai	LASHTAI	LUSHTAI.
Waria'gai	URIASGAI	Uriagai.
Zangiwa'l	Zangiwa'l	Zangiwa'l.
Khankai	Konkai Chaplai	Konkai. }
Ro'dli'n	KUDISAI	•••
Navgivya'la	MALAIYAM	MALAIAN.
La'ho'r	La'hor	Lahore.
Dilai	DELHI	DELHI.
Mu'ltat	MUDDUK	Muddun.
DARGAI	DARGAI	DARGAI.
SHABOZAI	Shabozai	SHABOZAI.
SHARAN	Sho'ra'n	Shora'n.

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On the Suryaprajñapti.—By Dr. G. Thibaut, Principal, Benares College.

PART II.

(Continued from p. 127.)

Although ancient Indian astronomy was chiefly interested in the moon and although the greater part of the Súryaprajñapti treats of her, especially of the places she occupies at different times in the circle of the nakshatras, a detailed connected account of her motions is not given anywhere, and we must combine the hints we meet with here and there, in order to understand the theory by which the old tirthankiras tried to explain to themselves her motion. In doing this we are of course greatly aided by the full and unambiguous account given of the sun's motion, since it will not be presuming too much that the theory which had been applied to the one luminary would be applied to the other one also. As we have seen above, the sun's daily apparent motion is regarded to be his true one and considered to take place round Mount Meru; his yearly motion is the consequence of his moving more slowly than the stars; his motion in declination is the result of his describing round Mount Meru circles of varying diameter. All this is applied to the moon too. The moon describes (or the two moons describe) circles round Mount Meru at the height of eight hundred and eighty yojanas above the earth, so that her place is eighty vojanas above that of the sun. She moves slower than the stars and slower than the sun; while the latter describes during one yuga 1,830 (or strictly speaking 915) circles, the moon describes only 1,768 (or again on the assumption of two moons 884) such circles; the difference of the two numbers = 62 indicates the number of times the moon enters into conjunction with the sun. During the same period, viz., the quinquennial yuga, the moon completes sixty-seven sidereal revolutions. Each of these revolutions is, analogously to the sun's revolutions, divided into two ayanas, an uttaráyana and a dakshináyana, according as the moon is proceeding towards the north or the south (of the equator as we should add). In reality, it is true, the motion of the moon is much more complicated, as it is not only oblique to the equator, like the ecliptic in which the sun is moving, but also inclined to the ecliptic itself at an angle of about 5°, while moreover at the same time the points in which the moon's path cuts the ecliptic are continually receding. One of the consequences of the revolution of the nodes did, as we shall see below, not escape the observation of the author of the Súryaprajñapti, but he was manifestly unable to account for it by a modification of his theory. According to him the moon, like the sun, simply describes concentric circles round Mount Meru, sometimes approaching it sometimes receding from it. While, however, the period of the sun's progress from and towards Mount Meru comprises one yearthe time which the sun employs in arriving again at the same star—the corresponding period of the moon embraces one nakshatra month = 27 days, 9 37 muhúrtas. From this it is easy to find the number of the circles the moon describes. She performs during one yuga 1,768 complete revolutions, consequently during one nakshatra month $\frac{1768}{67} = 26 \frac{26}{67}$ revolutions, and during one ayana or sidereal half month $13\frac{13}{67}$ revolutions. The moon therefore proceeds towards the north during the time which she wants for describing 13 $\frac{13}{67}$ circles, and after that she proceeds towards the south for the same length of time. From this it follows that, while the sun has 184 different circles to describe, the moon has fifteen such circles only. At the beginning of the yuga she leaves the outermost circle and begins her uttaráyana, describes the thirteen circles intermediate between the outermost and the innermost ones and enters into the fifteenth (innermost) circle, through $\frac{13}{67}$ parts of which she passes. After that the sidereal half moon has elapsed, and the moon has to retrace her steps towards the south. therefore leaves the innermost circle unfinished, returns into the next one, passes again through the 13 intermediate circles and enters into the 15th (outermost) circle. After she has passed through $\frac{13}{67}$ parts of the latter, the sidereal half moon is again over and the progress towards the north Thus the moon moves in 15 circles of different diameter, but only 13 she passes through in their entirety while a fractional part only of the two exterior circles are touched by her. We have seen above that the vikampa-kshetra of the sun, i. c., the extent to which the sun moves sideways in his northern and southern progress is estimated at 510 yojanas (= 183 × 2 $\frac{48}{61}$; the latter quantity being the amount of the daily vikampa); the vikampa-kshetra of the moon is estimated at nearly the same amount, viz., $509 \frac{53}{61}$ yojanas (it has been already remarked that the inclination of the moon's path to the ecliptic is not known to the Súrysprajñapti). The diameter of the moon herself is estimated at $\frac{56}{61}$ yojanas, the interval between consecutive circles described by the moon at $85 + \frac{80}{61} + \frac{4}{7 \times 61}$ yojanas; the sum of these two quantities is $36 + \frac{25}{61}$

imagine it similar to that of the sun.

 $+\frac{4}{7\times61}$, which multiplied by 14, gives the above stated amount $\left(509\,\frac{53}{61}\right)$ as the whole vikampakshetra during one lunar half month. Here—as likewise above with reference to the sun—the Súryaprajñapti does not directly speak of the diameter of the moon, but of the measure of the breadth of the circle described by the moon; but the two things come to the same. The manner in which the moon, after having completed one of her circles, passes over into the next one is not expressly detailed; we must

In connexion with this account of the moon's motion, the Súryaprajusti enters into a curious calculation, of no practical, and it can hardly be mid any theoretical interest, which, however, may be mentioned here as a specimen of the accuracy with which the system is worked out into its minutest details. The question is raised: what circles are common to the sun and moon and how far are those of the moon's circles which belong to the sun also touched by the latter? As the moon's circles are elevated above those of the sun by the amount of eighty yojanas, strictly speaking not any circle is common to both; common to both are, however, said to be those circles of the moon which when projected upon the plane in which the sun describes his circles partially or entirely coincide with the latter. The vikampa-kshetras of the two being nearly equal, while 15 circles of the moon correspond to 184 circles described by the sun, the consequence is that the by far greater portion of the sun's circles do not coincide with the moon's circles, but fall into the wide intervals separating the latter, one from Thus for instance the first (innermost) circle of the sun coincides with the first circle of the moon, so that when both luminaries move in their innermost circles their distance from Mount Meru is equal; only the circle of the moon overlaps that of the sun by $\frac{8}{61}$ yojanas, this being the difference of the breadth of the circles described by the two (of the diameters of the two bodies). The next twelve circles of the sun all fall into the interval between the first and the second circle of the moon; for this interval (plus the overlapping $\frac{8}{61}$ of the first circle) amounts to $35 + \frac{38}{61}$ $+\frac{4}{7\times61}$ yojanas, while the vikampa-kshetra of twelve solar circles amounts to 33 $\frac{27}{61}$ yojanas only. After that two yojanas are occupied by the interval between the 13th and the 14th solar circles, and then the fourteenth solar circle begins, which therefore partly coincides with the second lunar circle. By continuing these calculations for all lunar circles, it is

found that the first up to the fifth inclusive, and again the eleventh up to the fifteenth inclusive are "súrya-sammiśráni," i. e., partly coincide with solar circles, while the sixth up to the tenth do not coincide with solar circles, the latter falling entirely into the intervals between the named lunar cir-To reproduce here all the details of the calculation would be purposeless.—That the preceding account of the moon's motion agrees with the ideas of the author of the Súrvaprajñapti is to be concluded from the formulas given in different parts of the work for the performance of certain calculations. Thus for instance the question is raised, in what ayana and what circle each parvan takes place, i. e., how many ayanas have elapsed at the different times when the moon enters into conjunction or opposition and in which of the fifteen circles she is moving just then. This question is answered by some ancient gáthás quoted in the commentary, according to which the calculation has to be made as follows. The constant quantity—the भ्रवराहितwhich is to be used for the calculation of each parvan, is equal to $1 + \frac{4}{67} + \frac{9}{31 \times 67}$, viz., of one of the circles described by the moon. This quantity is of course easily found by the following consideration. The moon which describes in one yuga 1,768 circles describes in one parvan $\frac{1768}{124} = 14\frac{8}{31}$ circles and in one ayana 13 $\frac{13}{67}$ circles; the difference of these two quantities is the above mentioned constant quantity. The rule for finding the places of the parvans is now as follows: The way accomplished by the moon during one parvan being equal to the way accomplished during one ayana plus $1 + \frac{4}{67} + \frac{9}{81 \times 67}$ circles, take at first as many ayanas as the number of the parvan whose place is wanted indicates, multiply then the constant quantity by the number of the parvan, and if the result exceeds 13 $\frac{13}{67}$, deduct it from this latter quantity (which subtraction if necessary has to be repeated until the remainder is less than 13 $\frac{13}{67}$; as often as this subtraction is performed as many unities are to be added to the number of ayanas found above and—unless the subtraction leaves no remainder—one additional unity is to be added; add two to the remainder; the resulting sum will indicate the circle in which the moon stands at the parvan. Regarding this latter point it is to be remembered that the circles are to be counted from the innermost circle when the number of the parvan is an even one and from the outermost circle when it is an odd To illustrate this let us take one of the many examples given by the Required the place of the moon at the fourteenth parvan. Commentator. Multiply at first one by fourteen, that means: fourteen ayanas have elapsed

at the time. Then multiply $1 + \frac{4}{67} + \frac{9}{81 \times 67}$ by fourteen; the result is $14 + \frac{56}{67} + \frac{126}{31 \times 67} = 14 + \frac{60}{67} + \frac{2}{31 \times 67}$. This is the number of circles which the moon has passed through during fourteen parvans in addition to fourteen ayanas. As this number exceeds the number of circles passed through in one ayana $(viz., 13 \frac{13}{67})$, the latter number has to be deducted from it and one has to be added to the number of ayanas. we see that the moon has performed 15 ayanas at the end of the 14th parvan. The remainder left after the above deduction shows the number of circles which the moon has passed through in addition to the 15 complete ayanas; in our case these amount to $1 + \frac{47}{67} + \frac{2}{31 \times 67}$. As there is an excess above 15 complete ayanas, we have according to the rule to add one to their number, i. e., the parvan takes place in the sixteenth ayana. And since the moon enters at the beginning of the ayana into the second circle (the circles being counted from the innermost as well as the outermost) and since in our case the moon has completed more than one full circle, two has to be added to the number of circles found above in order to obtain the ordinal number of the circle in which the moon stands at the expiration of the 14th parvan. The full answer is therefore: the 14th parvan takes place in the sixteenth ayana, in the third circle (reckoning from the innermost circle), $\frac{47}{67} + \frac{2}{31 \times 67}$ of this circle having already been passed through. In the same manner the places of all other parvans may be easily found; the commentator gives the places of parvan I—XV; but it would serve no purpose to extract them here. What has been given will suffice to justify the hypothetical account of the moon's motion detailed above.

The question regarding the relative velocity of sun, moon and stars which is raised in the 15th book finds its answer in accordance with the general principles of the system. The apparent daily motion being considered as the real one, it follows that the nakshatras travel faster than the sun, and the sun again faster than the moon; the space passed through by each of these bodies during a month, day, muhurta, etc. is calculated and exhibited in detail; we need, however, only remember that the sun describes in one yuga 1,830 circles, while the moon describes only 1,768 and the nakshatras—through whose circle the sun passes five times—describe 1,835. From these relations all special values can be easily derived. It is just mentioned—no details being given—that the planets (graha) travel faster than the sun and the stars (táráḥ) faster than the nakshatras. It is needless to discuss the former of these two assertions; the latter is of course

entirely indefensible and no reason leading to it can well be imagined. This is the only time that the stars—excluding the nakshatras—are mentioned in the Súryaprajñapti as far as we can judge from the commentary.

The next point to be considered is the information the Súryaprajñapti furnishes with regard to the nakshatras. Incidentally it has already been remarked that the number of the nakshatras is invariably stated as being twenty-eight, and that the nakshatras are as invariably treated as being of different extent. The particulars are as follows:

According to their extent or, to look at it from another point of view. according to the time during which sun and moon are in conjunction with them, the nakshatras are divided into four classes. Firstly, those with which the moon is in conjunction during one ahoratra = thirty muhurtas: to this class belong Revatí, Aśviní, Krittiká, Mrigaśiras, Pushya, Maghá, Púrvaphálguní, Hasta, Chitrá, Anurádhá, Múla, Púrváshádhá. Sravana. Sravishthá, Púrvabhádrapadá. The one ahorátra for which the conjunction lasts may be expressed as $\frac{2010}{67}$ muhúrtas, the convenience of which expression will appear at once. The second division comprises those nakshatras which are in conjunction with the moon for half a nycthemeron = fifteen muhúrtas = $\frac{1005}{67}$ muhúrtas; to this division belong Satabhishaj, Kśleshá, Bharani, Jyeshthá, Ardrá, Sváti. To the third division belong those nakshatras with which the moon is in conjunction for one and a half nycthemeron = 45 muhúrtas = $\frac{3015}{67}$ muhúrtas; these nakshatras are Uttaráshádhá, Uttaraphálguní, Uttara-bhádrapada, Punarvasu, Visákhá, The fourth division comprises one nakshatra only, viz., Abhijit, with which the moon is in conjunction for $9\frac{27}{67} = \frac{630}{67}$ muhurtas. We see now for what reason the time of conjunction has been expressed throughout in sixty-sevenths of a muhurta; it was done for the purpose of obtaining homogeneous expressions for all nakshatras. At the same time these fractions furnish us with an easy means for calculating the time during which the sun is in conjunction with each nakshatra; for five revolutions of the sun occupying the same time as sixty-seven revolutions of the moon, we have only to replace the denominator of the above fractions by five. The result of this operation having been turned into nycthemera, we find as the expression for the time during which the sun is in conjunction with the nakshatras of the four divisions the four following terms: 13 days, 12 muhúrtas; 6 days, 21 muhúrtas; 20 days, 3 muhúrtas; 4 days, 6 muhúrtas. -- According to the space the nakshatras occupy they are either samakahetra, occupying a mean (medium) field or apárdhakshetra, occupying

half a field or dvyardhakshetra, occupying one field and a half. There is no special name for the extent of Abhijit.

In connexion with this division of the nakshatras into different classes according to the space they occupy or the time during which they are in conjunction with the moon, there is another one referring to the time of the day or the night at which they enter into conjunction. This classification is, however, connected with considerable difficulties. It is nowhere clearly stated on the conjunctions of what particular month this division is based; that such a statement ought to have been given, appears from the consideration that the periodical month during which the moon passes through all nakshatras comprises 27 days plus $\frac{27}{67}$ days, and that therefore in the second, third, fourth, etc. months the times at which the moon enters into conjunction with the single nakshatras will all differ from the times of the first month. If for instance the moon at the beginning of the first month enters into conjunction with Abhijit in the early morning, she will at the beginning of the second month again enter into conjunction with it $9\frac{27}{67}$ muhúrtas later, that is, in the afternoon and so on. difficulties will appear from the following detailed reproductiou of the Súryaprajñapti's account concerning this point. The nakshatras are either "púrvabhága" i. e., such as enter into conjunction with the moon during the forenoon; or "páschádbhága" i. e., such as enter into conjunction during the afternoon or "naktambhága" i. e., such as enter into conjunction during the night or "ubhayabhága" which term will be explained further The nakshatras of the two first classes are the samakshetras, those of the third class the apardhakshetras, those of the fourth class the dyvardhak-It certainly does not appear why the samakshetras should enter into conjunction with the moon during the day only and the apardhakshetras during the night only; in reality there is no connexion between the extent of a nakshatra and the time when the moon enters into it. however, follow the detailed statements about each single nakshatra. first aphorism of the Súryaprajñapti appears to be "Abhijit and Sravana are paschadbhaga samakshetra." To this the commentator rightly objects that Abhijit is neither samakshetra, since it occupies only 9 $\frac{27}{67}$ muhúrtas of the moon's periodical revolution, nor paschadbhaga, since at the beginning of the yuga the moon enters into conjunction with it in the early morning. At the same time he tries to obviate these objections by remarking that Abhijit is called samakshetra and paschadbhaga, because it is always con-

nected with Sravana to which both these attributes rightly belong, or that it may be called paschadbhaga with a view to conjunctions other than the

first one which may take place in the course of the yuga. But these both attempts at reconciling contradictions are very unsatisfactory. Howsoever this may be, the commentator goes on to explain that Abhijit and Sravana, after having finished their conjunction with the moon, hand her over to Dhanishthá at evening (Abhijit-śravano dve nakshatre sáyam-samayád árabhya ekám rátrim ekam cha sátirekam divasam chandrena sárddham vogam yuktah etávantam kálam yogam yuktvá tad-anantaram vogam anuparivartayatah átmanas chyávayatah yogam chánuparivartya sáyam divasasva katitame paśchádbháge chandram dhanishtháyáh samarpayatah). For this reason Dhanishthá also is paschádbhága. After having been in conjunction with it for thirty muhurtas the moon enters Satabhishaj at the time when the stars have already become visible (parishphutanakshatramandalávaloke); Satabhishaj is therefore naktambhága. How Satabhishai enters into conjunction at night, while exactly one aboratra before Dhanishthá has been said to enter into conjunction during the afternoon, is not explained. Satabhishaj being apardhakshetra, the moon remains in conjunction with it for fifteen muhurtas only and enters on the next morning into conjunction with Púrva-proshthapada, which being samakshetra remains in conjunction during one whole ahoratra. On the following morning the moon enters Uttara-proshthapada, which therefore would be purvabhaga. But the matter is looked at in a different light, Uttara-proshthapada is dvyardhakshetra, i. e., remains in conjunction for 45 muhurtas. If we now deduct from this duration the fifteen first muhurtas and imagine Uttaraproshthapada to be samakshetra, the conjunction of the moon with itlooked at as samakshetra-may be said to take place at night and in consequence one-the real-conjunction taking place during the day and the other—the fictitious one—taking place at night the nakshatra is called ubhayabhága (idam kilottarabhádrapadákhyam nakshatram uktaprakárena prátas chandrena saha yugam adhigachchhati, kevalam prathamán pañchadaśa muhúrtán adhikán apaniya samakshetram kalpayitvá yadá yogas chintyate tadá naktam api yogo 'stíty ubhayabhágam avaseyam). Uttarabhádrapada remains in conjunction for one day, one night and again one day, on the evening of which the moon enters Revatí; Revatí is therefore paschadbhaga. After it has remained in conjunction for one nychthemeron the moon passes into Aśvini at evening time. Aśvini is therefore likewise paschádbhága. From it the moon passes on the next evening into Bharaní, at the time, however, when the stars have become visible and night may be said to have begun; Bharaní is therefore naktambhága. Being at the same time apardhakshetra, the moon leaves it on the next morning to enter Krittika, which therefore is purvabhaga. On the next morning the moon enters Rohini which is dvyardhakshetra and, on account of that, ubhayabhága. Mrigasiras which she enters forty-five muhurtas

later at evening is paschádbhága; Ardrá which enters into conjunction thirty muhurtas later, at the time when the stars have come out, is naktambhaga: Punarvasu into which the moon enters on the next morning, being dvyardha, is ubhayabhaga. Pushya comes into conjunction on the evening of the following day and is paschadbhaga; Kslesha thirty muhurtas later, when the stars have come out, and is naktambhaga; Magha and Purvaphalguní into which the moon enters on the mornings of the two following days are púrvabhága; Uttara-phalguní which comes into conjunction on the morning after that is ubhayabhága, because it is dvyardhakshetra. Hasta and Chitrá enter into conjunction on the evenings of the two following days, before night has set in, and are therefore paschadbhaga. Then again follows one naktambhága nakshatra, viz., Svátí which enters into conjunction after nightfall, and upon this a dvyardhakshetra and consequently ubhayabhága nakshatra, viz., Visákhá. Then Anurádhá paschád. bhága, after this Jyeshthá, apárdhakshetra and naktambhága, remaining in conjunction from nightfall to the morning only; after this two samakshetra and púrvabhága nakshatras, viz., Múla and Púrváshádhá. And finally Uttaráshádhá, which enters into conjunction on the morning, is, however, as a dvyardhakshetra, reckoned among the ubhayabhaga. It remains in conjunction for one nycthemeron and the following day, in whose evening the moon arrives at Abhijit whence she had started a (periodical) month ago.

The difficulties involved in all the preceding statements are increased by an assertion made in another chapter of the Súryaprajñapti, viz., that no nakshatra always enters into conjunction with the moon at the same time of the day. This is indeed true, but it contradicts the preceding statements. It may be that this whole classification of the nakshatras according to the time of the day at which they enter into conjunction with the moon is a remainder of an earlier stage of knowledge, when the periodical month was supposed to last just twenty-seven days without an additional fraction, and when it therefore was possible to assign to each nakshatra one fixed hour at which it entered into conjunction during each periodical revolution of the moon. It is true that actual observation would speedily have shown the error of such an assumption, but this remark would apply to almost all hypotheses of the Indians of that period, and we may therefore suppose that in this point too the desire of systematizing prevailed during a certain period over the testimony of the eyes. Later on when the duration of the periodical month had become better known, the old classification lost its foundation entirely and ought to have been dropped; but through the force of custom it maintained its place and was justified some how, although not with the best success, as we have had occasion to observe above.

On the places of the nakshatras with regard to the moon we receive

the following information (X. 11). Six nakshatras, viz., Mrigasiras, Ardrá, Pushya, Aśleshá, Hasta, Múla always stand to the south of the moon whenever she enters into conjunction with them. Twelve nakshatras-Abhijit, Sravana, Dhanishthá, Satabhishai, Púrva-bhádrapadá, Uttara-bhádrapadá, Revatí, Aśviní, Bharaní, Púrva-phálguní, Uttara-phálguní, Svátí always stand to the north of the moon. Seven nakshatras-Krittiká, Rohiní, Punarvasu, Maghá, Chitrá, Visákhá, Anurádhá-sometimes stand to the north of the moon entering into conjunction with them; sometimes, however, the moon enters into conjunction with them "pramardarupena" viz., in such a manner that she passes right through them. To this class, the commentator remarks, some teachers holding an opinion different from that of the Súrvaprajñapti add also Jyeshthá. Two nakshatras, viz., the two Ashádhas stand at the time of conjunction either to the south of the moon or the latter passes right over them. Both these nakshatras consist of four stars each, two of which are situated inside, viz., to the north of the fifteenth circle of the moon, while the two remaining ones are placed outside, viz., to the south of the same circle. Now whenever the moon enters into conjunction with either of the two nakshatras, she passes right between the former pair of stars and may therefore be said to be in conjunction "pramardarúpena." Finally one nakshatra, viz., Jyeshthá, always enters into conjunction with the moon pramardarúpena. Regarding the relation of the nakshatras to the fifteen circles of the moon, the following statements are made. Eight circles always are "undeprived" (avirahitáni) of The twelve nakshatras mentioned above, beginning with Abhijit, are in the first circle; in the third circle there are Punarvasu and Maghá; in the sixth, Krittiká; in the seventh, Rohiní and Chitrá; in the eighth, Visákhá; in the tenth, Anurádhá; in the eleventh, Jveshthá; in the fifteenth, Mrigasiras, Ardrá, Pushya, Asleshá, Hasta, Múla and the two Ashádhás. For although the first six of the last mentioned class in reality move outside the fifteenth circle, they are—the commentator says—so near to it that they may be said to be in it. In order to form a right estimate of the meaning and the value of these statements, we must recall to our mind what has been remarked above about the Súryaprajñapti's theory of the moon's motion. The moon is supposed to proceed alternately towards the south and the north in the same way as the sun does, following -as the Súryaprajñapti seems to assume—the same path; that she in addition to the movement in declination has a movement in latitude, and that the points in which her orbit cuts the ecliptic are continually receding is ignored, theoretically at least, although it had been observed that the position of the moon with regard to some nakshatras is different at different times, that she sometimes passes on the north or south-side of a constellation and at other times moves right through it. Now comparing the particulars

with the information given about the position of the nakshatras in the Siddhántas, we find that the Súryaprajñapti agrees with the latter with regard to five out of the six nakshatras said always to stand south of the moon (Mrigasiras, Ardrá, Asleshá, Hasta, Múla), the latitude of all of them considerably exceeding the highest latitude the moon ever reaches. case lies differently with regard to Pushya, which according to the Siddhántas lies in the ecliptic, so that it almost appears as if the Pushva of the Súryaprajñapti were an altogether different asterism. From among the twelve nakshatras said to stand always north of the moon ten (Abhijit, Sravana. Sravishthá, Púrva-Bhádrapadá, Uttara-Bhádrapadá, Asviní, Bharaní, Púrva-Phálguní, Uttara-Phálguní, Svátí) may be identified with the nakshatras of the Siddhantas whose latitudes—excluding Abhijit—vary from 9° to about 39° north. Strange it is only that these nakshatras occupying a zone of about 21° breadth are said to be in one and the same circle of the moon, and still stranger that Abhijit too is classed among them, the latitude of the latter-if identical with the Abhijit of the Siddhantas-exeeeding the latitudes of the other nakshatras, with which it is here thrown into one class, by about 30°. The Satabhishaj and Revatí of the Siddhántas are situated in and close to the ecliptic; here too therefore we might doubt if the Súryaprajñapti denotes by these two names the same stars as the Siddhantas. The remaining nakshatras may be identified with those of the Siddhantas, the latitude of none of the latter much exceeding the greatest latitude reached by the moon; a considerable margin must of course be allowed for the inaccuracy of the observations on which the statements of the Súryaprajñapti are based. Quite unfounded is the statement about the moon always passing right through Jyeshthá; it looks as if it had originated at some period when one of the moon's nodes had about the same longitude as that asterism.

The order of succession of the nakshatras is treated in X. 1., Of five different pratipattis regarding this point the author details only one, viz., that one according to which Krittiká stands first. The author of the Súryaprájñapti for his part calls Abhijit the first nakshatra, since according to his system at the beginning of the yuga on the day of the summer solstice early in the morning the moon which is full at that time stands in Abhijit. He therefore altogether abandons the principle, sometimes followed, according to which the enumeration of the nakshatras begins with that nakshatra in which the sun stands on the day of the vernal equinox; if he too had chosen this principle he would of course have begun his enumeration with Aśviní. It may here be mentioned by the way that the Súryaprajñapti does not occupy itself at all with the equinoxes, the name of which is not even mentioned in the whole work.

We now proceed to consider some specimens of the numerous cal-

culations, rules for the performance of which are contained in the Súryaprajñapti itself as well as in a great number of old karaṇa-gáthás quoted
by the commentator; remarking at once that the rules contained in the
gáthás presuppose exactly the same system as the rules of the Súryaprajñapti itself. A comparison of these calculations with those contained in
the jyotisha-vedánga shows the extreme likeness and in many cases the
complete identity of the two sets; a result which supplies another reason
for looking on the Súryaprájñapti as—in all essential points—a fair representative of Indian astronomy anterior to the period of the Siddhántas.
Several of these calculations have already been reproduced above incidentally; in the following a detailed account of the more important ones
among those not yet touched upon will be given.

It appears that before the influence of Greek astronomy made itself felt in India, the division of the sphere into 27 or 28 nakshatras was the only one employed and that no independent subdivisions of the nakshatras This want was, however, supplied by a simple transfer were made use of. of the subdivisions of time to the nakshatras. In accordance with this principle the Súryaprajñapti divides the sphere into 819 $\frac{27}{67}$ muhúrtas, this being the duration of the periodical revolution of the moon, and allots to each nakshatra a certain number of muhurtas according to its greater or smaller Fixed subdivisions of the muhurta such as are commonly met in Indian astronomical works are, however, nowhere employed by the author of the Súryaprajñapti; he apparently preferred to keep himself perfectly free from restrictions of this kind and uses throughout those fractions of the muhurta only which were immediately suggested by the various calculations in hand. From the general nature of the yuga it is manifest at once which fractions will present themselves most readily; they are sixtyseconds and sixty-sevenths (62 = number of synodical months in a yuga, 67 = number of periodical months) and, whenever lunar months of both kinds enter into the calculations, sixty-sevenths of sixty-seconds.

One of the most important rules is that which teaches how to find the place of the moon on any parvan. In the following the details of the calculation furnished by the commentator will be stated in extenso, so that at least one complete specimen of computations of this kind may be exhibited.—If we wish to devise a rule for calculating the place of the moon in the circle of the nakshatras at any parvan, we must at first find the constant quantity—the dhruvarási—entering as a multiplicand into all calculations of this kind. This in our case is clearly the space passed through by the moon during the lunar month, or more simply, because entire revolutions which bring the moon back to the same place can be neglected, the excess of the lunar synodical month above the periodical

From what is known about the general constitution of the yuga this quantity is of course readily found to be equal to $66 + \frac{5}{69} +$ The commentator calculates this quantity as follows. sun performs during 124 parvans five complete revolutions, how much does he perform during 2 parvans (= one synodical month); answer: $\frac{5 \times 2}{194}$ = This therefore is the excess of the synodical month above the periodical one. In order that the division can be carried out, the $\frac{b}{co}$ rev. are turned into nakshatras by multiplying them by $\frac{1830}{67}$ (i. s. by $27\frac{21}{67}$, the duration in ahorátras of the periodical month or, if we like, the extent of the nakshatras; 27 entire nakshatras plus the fractional nakshatra Abhijit). Result of the multiplication $\frac{9150}{4154}$. Again—in order to turn the days or nakshatras into muhurtas—the numerator is multiplied Result = $\frac{274500}{4154}$. This division being performed gives as result 66 muhúrtas. The remainder 336 is multiplied by 62 and the product again divided by 4154. Result $=\frac{5}{62}$ muhurtas. The remainder—62 should again be multiplied by 67 (the fractions employed being throughout sixty-seconds and sixty-sevenths) and divided by 4154; but 4154 being itself = 62×67 , it is seen at once that the result is 1. whole quantity is $66 + \frac{5}{62} + \frac{1}{62 \times 67}$ muhúrtas. If now the place of the moon at any amávasyá or púrnamásí is wanted, the above quantity has to be multiplied by the number of the parvan; for instance, by one if the moon's place at the first full moon after the beginning of the yuga is wanted. The product shows how far the moon at the time has advanced beyond the place she had occupied at the beginning of the yuga, if full moons are concerned, or beyond the place she had occupied at the new moon preceding the beginning of the yuga, if new moons are concerned, (the new moon im_ mediately antecedent to the beginning of the yuga having been selected as starting-point for all calculations concerning new moons). So far the place of the moon is expressed in muhartas only; now in order to find from these the nakshatra in which the moon stands at the time, we should

have to deduct from the muhúrtas found the extent of all the nakshatras through which the moon has passed one after the other, until the sum would be exhausted. Thus, for instance, if we wanted to find the place of the moon at the third new moon after the beginning of the yuga, the constant quantity $66 + \frac{5}{62} + \frac{1}{62 \times 67}$ would have to be multiplied by 3, so that we should have $198 + \frac{15}{62} + \frac{8}{62 \times 67}$ muhurtas. Now the moon standing at the new moon preceding the beginning of the yuga in Punarvasu, of which she has still to pass through 22 $\frac{46}{62}$ muhúrtas, we have to deduct this last quantity from $122 + \frac{10}{62} + \frac{2}{62 \times 67}$; from the remainder we should have to deduct 30 muhurtas (the extent of Pushya); from the remainder again 15 (Kśleshá); again from the remainder 30 (Maghá), and so on, until in the end the fact of the remainder being smaller than the next following nakshatra would show that new moon takes place in that nakshatra.—In order, however, to shorten this somewhat lengthy process, certain subtrahends are formed out of the sum of the extent of several nakshatas, which materially alleviate the work by substituting one subtraction for a number of subtractions. Thus with reference to new moon—the subtrahend (sodhanaka) for Uttara-phálguní is said to be 172, for Visákhá 292, for Uttara-áshádhá 442; i. e., if from the product of the constant quantity by the number of the new moon 172 can be deducted, we see at once that the moon has advanced beyond Uttara-ashadhah; if 292 can be deducted, she has passed the limits of Visákhá and so on. trahends are not carried on from Punar-vasu beyond Uttara-áshádhá, but make a fresh start from Abhijit, apparently in order to make them available for the calculation of the places of the full moons too. Thus the subtrahend for Abhijit is 9 and a fraction, of Uttara-bhádrapadá 159, of Rohiní 309, of Punarvasu 399, of Uttara-phálguní 549, of Visákhá 669, of Múla 744, of Uttara-ashádhá 819.

The places in which the different full moons of the yuga occur are found by an exactly similar proceeding; only all calculations have to start not from Punarvasu, but from the beginning of Abhijit where the first full moon which coincides with the beginning of the yuga takes place. The text enumerates the places of all full moons and new moons of the yuga at length, carrying in each case the calculations down to sixty-sevenths of sixty-seconds of muhúrtas. It is needless to reproduce these lists here in extenso, as any place wanted can be calculated with ease from the general rule given above.

The same result, viz., to find the place of the moon on a given parvan is obtained by following another rule contained in some gathas quoted by the commentator. Their purport is as follows. Multiply sixty-seven (the number of periodical revolutions which the moon makes during one yuga) by the number of the parvan the place of which you wish to find and divide this product by one hundred and twenty-four (the number of parvans of one yuga). The quotient shows the number of whole revolutions the moon has accomplished at the time of the parvan. The remainder is to be multiplied by 1830 (viz., 1830 sixty-sevenths which is the number of nycthemera of one periodical month) or more simply by 915 (reducing 1830 as well as the denominator viz., 124 by two). From the product (remainder multiplied by 915) deduct 1302, which is that part of a whole revolution which is occupied by Abhijit (Abhijit occupies $\frac{21}{67}$ days, but as this amount is to be deducted from the numerator of a fraction the denominator of which is 62, 21 is to be multiplied by 62; product = 1302). of Abhijit, from which the moon's revolutions begin, is deducted at the outset, because it is greatly smaller than the portion of all other nakshatras and would disturb all average calculations. After it is has been deducted the remainder is divided by 67 × 62; the quotient shows the number of nakshatras beginning from Sravana which the moon has passed through, in addition to the complete revolutions. The remainder is again multiplied by thirty, the product divided by 62; the quotient shows the number of muhurtas during which the moon has been in the nakshatra in which she is at the time. And so on down to small fractions of nakshatras. The following is an example. Wanted the place of the moon at the end of the second parvan. Multiply 67 by 2; divide the product by 124. tient (1) indicates that the moon has performed one complete periodical The remainder (10) is multiplied by 1830 or more simply by 915 (see above): from the product (9150) the portion of Abhijit (1302) The remainder (7848) is divided by $67 \times 62 = 4154$; the quotient (1) shows that after Abhijit the moon has passed through one complete nakshatra, viz., Sravana. The remainder (3694) is multiplied by 30; the product (110820) again divided by 4154; the quotient (26) shows that the moon has moreover passed through 26 muhurtas of Sravishthá. By carrying on this calculation we arrive at the result that at the end of the second parvan the moon stands in Sravishthá, of which she has passed through $26 + \frac{42}{62} + \frac{2}{62 \times 67}$ muhúrtas.

Analogous calculations are made for the sun too. For instance, in what circle does the sun move at the time of each parvan? The rule here is very simple. Multiply the number of the parvan by fifteen (the number

of tithis of one parvan) and from the product deduct the number of avamaratras (excessive lunar days) which occur during the period in question. If the parvan occurs during the first ayana of the sun, the remainder immediately indicates the number of the solar circle which is in fact the same as the number of the civil day on which the parvan happens; if the parvan takes place during one of the other nine ayanas, the remainder must at first be divided by 183 (number of circles described by the sun during one ayana); etc. The rule is simple and needs no illustration.

The rule for finding the nakshatra in which the sun stands at the time of each parvan (the súryanakshatra) is quite analogous to the rule given above for the moon. The sun makes in one yuga five complete revolutions, in one parvan $\frac{5}{124}$ revolutions. This quantity is to be multiplied by the number of the parvan and then we have as above to descend by continued multiplication and division to nakshatras, sixty-second parts of nakshatras and sixty-seventh parts of sixty-second parts. Instead of deducting the portion belonging to Abhijit at the beginning of which the moon stands on the first day of the yuga, we have to deduct that part of Pushya which the sun has not yet passed through at the beginning of the yuga; it amounts to $\frac{44}{67}$ of a nychthemeron. All the remainder of the calculation is the same as in the moon's case and illustrative examples are therefore not wanted.

Besides there is another and considerably simpler method for finding the sun's place at the end of a parvan; it is likewise contained in some old karana-gáthás. The rule again assumes a "dhruvarási", a constant quantity, to be used in all calculations of this kind. This quantity is $33 + \frac{2}{62} + \frac{34}{62 \times 67}$ muhúrtas; for if we divide the whole circle of the nakshatras into $819 \frac{27}{67}$ muhúrtas (which is the time occupied by a complete revolution of the moon) the above amount expresses the way the sun accomplishes during one parvan. This quantity has therefore to be multiplied by the number of the parvan required, and by subtracting from the product at first the $19 + \frac{48}{62} + \frac{33}{67 \times 62}$ muhúrtas belonging to Pushya, after that the 15 muhúrtas of Aísleshá, after that the 80 muhúrtas of Maghá etc., we find in the end the nakshatra in which the sun completes the parvan. In order to facilitate these somewhat lengthy subtractions, the muhúrtas of a certain number of nakshatras are again added and presented in a tabular form. So for instance 139 muhúrtas (19 + 15 + 30 + 30 + 45) lead us up to

the end of Uttara-phálguní, and if therefore the product found in the manmer shown above exceeds 139, we may at once subtract 139 instead of performing five separate subtractions and know that the sun has at the time passed beyond Uttara-phálguní. The procedure is analogous to the one described above and needs no further illustration.

For finding how many seasons have elapsed on a certain tithi, the commentator quotes some gathas of the old teachers. The rule they contain is as follows. Multiply the number of the parvans which have elapsed since the beginning of the yuga by fifteen, and add to the result the number of tithis which have elapsed in addition to the complete parruns; deduct from this sum its sixty-second part; multiply the remainder by two and add to the product sixty-one; divide the result by one hundred and twenty-two; the quotient shows the number of seasons elapsed (which when exceeding six will have to be divided by six, since so many seasons constitute a solar year); the remainder divided by two shows the number of the current day of the current season. This rule seems not very well expressed, although it may be interpreted into a consistent sense. At first it must be remembered that the yuga does not begin with the beginning of a season, but with the month śrávana, while the current season—the rainy season—has begun a month earlier with ashadha. The calculation would hen, strictly expressed, be as follows. Take the number of parvans which have elapsed since the beginning of the yuga, add to it the tithis which have elapsed of the current parvan and add again to this sum 301 tithis (the tithis of áshádha plus half a tithi of the month preceding áshádha) and deduct from this sum its sixty-second part, viz., the so-called avamarátras, i. e., the lunar days in excess of the natural days (according to the Súryaprajñapti's system each sixty-second tithi is an avamarátra). The remainder of the calculation needs no explanation; the formula enjoins the addition of 61 instead of 304 and division by 122 instead of 61 (the number of days of a season) in order to get rid of the fractional part of 30%.

In order to find the number of the parvan during which an avamarátra occurs and at the same time the tithi itself which becomes avamarátra, the following rule is given. The question is assumed to be proposed in the following manner. In what parvan does the second tithi terminate while the first tithi has become avamarátra, or in what parvan does the third tithi terminate while the second is avamarátra? and so on, (kasmin parvani pratipady avamarátríbhútáyám dvitíyá samáptim upayáti, etc.) The answer is: if the number of the tithi which becomes avamarátra is an odd one, one has to be added to it and the sum to be multiplied by two; the result shows the number of parvans elapsed before the first tithi becomes avamarátra. If the number is an even one, one is added to it, the sum multiplied by two, and to the product thirty-one is added; the result again shows the

number of parvans elapsed. Thus for instance if it is asked: when does the first tithi become avamarátra? add one to one (number of the tithi) result two; this multiplied by two gives four; therefore pratipad is avamarátra in the fifth parvan, after four parvans have elapsed. Or again it may be asked: when does the second tithi become avamarátra? add one to two; result three; this multiplied by two gives six, to which thirty-one are added. The result—thirty-seven—shows that in the thirty-eighth parvan the second tithi is avama-rátra. Thus all the avama-rátras for the first half of the yuga are found and the same numbers recur during the second half. The rationale of this rule is obvious.

A simple rule is given for finding the tithis on which the avrittis of the sun, i. e., the solstices take place. Multiply the number of the solstice whose date you wish to know by 183 and add to the result three plus the number of the solstice; divide this sum by fifteen; the quotient shows the number of parvans elapsed, the remainder the number of the tithi of the current parvan. This rule—being based on the relation of tithis to savana days needs no explanation. The following list for the whole yuga results from these calculations.

1st Summer solstice (= 10th solstice of the preceding yuga).

,	1st	dark	half	of	śrávaņa.
1st Winter solstice,	7th	22	27	"	mágha.
2nd S. S.,	13th	• ••	"	,,	śrávana.
2nd W. S.,	4th	light	half	of	mágha.
3rd S. S.,	10th	"	"	,,	śrávana
3rd W. S.,	1st	dark	half	of	mágha.
4th S. S.,	7th))	"	,,	śrávana.
4th W. S.,	13th	"	,,	,,	mágha.
5th S. S.,	4th	light	half	of	śrávana.
5th W. S.,	10th	"	22	33	mágha.

The places which the sun occupies in the circle of the nakshatras at the time of the solstices have been mentioned before; the places of the moon at the same periods can of course be easily calculated when it is remembered that at the beginning of the yuga the moon just enters Abhijit. It is unnecessary to reproduce here the rule given for that purpose; it may

only be mentioned that the $\frac{7}{10}$ of a sidereal revolution which the moon performs during one solar ayana in excess of six complete revolutions constitute the "dhruva rási" for our case. The Súryaprajñapti likewise states the places in which the lunar ávrittis take place; from the circumstance that at the beginning of a yuga the moon is full in the first point of Abhijit and at the same time commences her progress towards the north, it follows

that her next progress towards the south takes place exactly on the same spot on which the sun was standing at the beginning of the yuga. At all following lunar avrittis the places of the two first ones of course recur.

Incidentally another rule is mentioned which certainly was of frequent application, viz., how to find on what natural day and at what moment of time during that day a given tithi terminates. The rule which is contained in an old karana-gáthá is of course very simple. Add together all tithis which have elapsed from the beginning of the yuga up to and including the tithi in question; divide this sum by sixty-two; multiply the remainder by sixty-one and divide again by sixty-two. The remainder is then the wanted The first division by sixty-two has the purpose to shew by its quotient—the number of complete avamarátras elapsed since the beginning of the yuga; this number has therefore to be deducted from the number of The remainder of the above division shows the number of tithis which have elapsed since the occurrence of the last avamarátra; to find by how much they remain behind the same number of natural days, they are multiplied by 61 and divided by 62 (61 natural days = 62 tithis); the remainder then indicates how many sixty-second parts of the current mtural day have elapsed at the moment when the tithi in question terminates.

Another old rule has the purpose of teaching how to find the number of muhurtas which have elapsed on the parvan-day at the moment when the new parvan begins. When the number of the parvan divided by four yields one as remainder (in which case it is called kaly-oja) we must add minety-three to it; if divided by four it yields two (in which case it is called dvápara-yugma), we add sixty-two to it; if it yields three (tretá-oja), we add thirty-two; if there is no remainder (krita-yugma), we add nothing. The sum which we obtain in each case is halved, then multiplied by thirty, The quotient shows the number of muhurtas finally divided by sixty-two. of the parvan-day which have elapsed at the moment when the new parvan The rationale of this rather ingenious rule is as follows. duration of one parvan is $14\frac{94}{124}$ days. The first parvan therefore terminates when $\frac{94}{124}$ of the day $=\frac{94\times30}{124}=\frac{47\times30}{62}$ muhúrtas have elaps-The number 94 may be obtained by adding 93 to 1, the number of the first parvan. The second parvan ends 29 $\frac{64}{124}$ days after the beginning of the yuga; 64 equals 62 + 2, the number of the second parvan. third parvan terminates $44 \frac{34}{124}$ days after the beginning of the yuga; 34

equals 81 + 3, the number of the third parvan. The fourth parvan terminates $59 \frac{4}{124}$ days after the beginning of the yuga; 4 without any addition

is the number of the parvan. The fifth parvan again terminates $73 \frac{98}{124}$ days after the beginning of the yuga; 98 is equal to 93 + 5, the number of the parvan. And so on through the whole yuga.

The above examples fairly represent the more important rules contained in the Súryaprajñapti. Now it will be apparent to every one who is to some extent familiar with the Jyotisha-vedánga* that the rules contained in the, as yet partly unexplained, verses of the latter refer to calculations exactly analogous to those contained in the Súryaprajñapti and the old gáthás quoted by the commentator.

From this it might be concluded that it is now easy for us to explain whatever has up to the present remained unexplained in the Vedánga, possessing as we doubtless do a clear insight into the general nature of the calculations for which it furnishes rules. But close as the connexion between the contents of the two treatises manifestly is, there are two reasons which preclude the direct application of the rules of the Súryaprajñapti to the elucidation of the Vedánga. In the first place the Vedánga divides the sphere into twenty-seven nakshatras only and, as far as has been ascertained up to the present, these twenty-seven nakshatras are considered to be of equal extent; while as we have seen above the Súrvaprajñapti throughout employs the division of the sphere into twenty-eight nakshatras of unequal extent. In the second place the starting point for all calculations (viz., the places of the winter and summer solstice) is not the same in the The consequence of these two fundamental discrepancies is that although the questions treated of are essentially the same and although the modes of calculation are strictly analogous the results arrived at in the two treatises necessarily differ in all cases, that for instance the place of a certain full or new moon during the quinquennial yuga can never be the same according to the Súrvaprajñapti as it is according to the Vedánga, etc. Nevertheless it is highly probable that somebody who should apply himself to the study of the obscure portions of the Vedánga after having made himself thoroughly conversant with the contents and methods of the Súryapra-

[•] Since the publication of the paper on the Jyotisha-vedánga in the 46th volume of this Journal, the writer has received some very important contributions to the explanation of the Vedánga from Dr. H. Oldenberg, the well-known editor of the Vinayapitakam, who working altogether independently had succeeded in explaining a number of hitherto obscure rules. The writer intends to revert to the Vedánga before long and will then avail himself of the new results most kindly placed at his disposal by Dr. Oldenberg.

jaapti, would succeed in solving some more of the riddles presented to us by the former work.

It must be remembered that there is no indissoluble connexion between that part of the system of the Súryaprajñapti, which might be called the chronometrical one, viz., the doctrine of the quinquennial yuga and its various subdivisions and that part which propounds the theories accounting for the apparent motions of the sun and the moon; it might therefore be that the Vedánga agrees with the Súryaprajñapti only in the former point and follows a different course with regard to the latter. There occurs, however, one expression in the Vedánga which makes it appear likely that the analogy between the two books extends to the second point also, viz., the "súryamandaláni" mentioned in verse 22.

चतीतपर्वमानेस्यः मेषयेट् हिनुच् तिचित्। तेच मण्डलमानेषु तिचित्रिष्ठां नती रविः॥

It certainly looks as if by these "sun circles" in which the sun is said to be at the end of a tithi, we had to understand daily circles of the same kind as those which, according to the Súryaprajñapti, the sun describes round Mount Meru.

A few words may here be added on the principal feature common to the cosmological systems of the Puranas, Buddhists and Jainas, viz., the doctrine of sun, moon and constellations revolving round Mount Meru. order rightly to judge of these conceptions we must remember that they arose at a time when the idea of the sphericity of the earth had not yet presented itself to the Indian mind, at a time (-if we may assume that the Puránic-Buddhistic cosmological system is not later than the period of the rising of Buddhism-) when this then truly revolutionary idea first suggested itself to the early Greek philosophers. And if we carry our thoughts back to that early stage of the development of scientific ideas and try to realize the conceptions which then were most likely to present themselves to enquirers, the old Indian system will lose much of its apparent strangeness and arbitrariness. How indeed could men ignorant of the fact that the earth is a sphere freely suspended in space explain to themselves the continually recurring rising and setting of the heavenly bodies? what could their ideas be regarding the place to which sun and moon went after their setting, and the path which unseen by man they followed so as to return to the point of their rising? Certainly the difficulty was a very great one to those as well who had some vague notion about the earth extending in all directions to an unlimited distance as to those who imagined it to be bounded at a certain distance by a solid firmament surrounding and shutting it in on all sides. We may recall, as one of the fancies to which the difficulty of this question gave rise, the old poetical idea, pre-

served, for instance, in a beautiful fragment of Stesichorus, of Helios when he has reached Okeanos in the west embarking in a golden cup which carries him during the night round half the earth back to the east whence he rises again. Under these circumstances we must admit that the old Indian idea of the constitution of the world, according to which the rising and setting of sun, moon and stars is only apparent, cannot by any means be called an unnatural one, and it is interesting to consider the counterparts it finds among what is known of the opinions of the oldest Greek philosophers.* So it is reported of Anaximenes that he supposed the sun not to descend below the earth, but to describe circles above it and to pass during the night behind high mountains situated in the north; an exact parallel to the Indian conception. Of Xenophanes we hear that he declared the sun, moon and stars to be only accumulations of burning vapour, fiery clouds kindling and extinguishing themselves by turns, that these clouds move in reality in straight lines and only appear to us to rise and to set in consequence of their varying distance, in the same way as the common clouds seem to rise from the horizon when they first become visible to us and seem to sink under the horizon when they pass out of our field of vision. These opinions too find their exact counterpart in the Súryaprajñapti and kindred works where the rising and setting of the heavenly bodies is declared to be an appearance caused by their consecutive approaching and receding, and where their movement is said to take place not indeed in a straight line but at any rate in a plane parallel to the plane of the earth. The first mentioned opinion of Xenophanes about the constitution of the heavenly bodies finds its analogon in one of the different pratipattis, mentioned in the Súryaprajñapti, according to which the sun is nothing but a "kiranasamgháta." an accumulation of rays forming itself every morning in the east and dissolving itself in the evening in the west. The cognate views held by Heraclitus concerning the nature of the sun are well known. Of Xenophanes it is further reported that he supposed different climes and zones of the earth, far distant from each other, to have different suns and moons; which is another striking parallel to the view held by the Jainas with reference to the different suns, moons and stars illuminating the different concentric dvipas of which the earth consists. In both cases the assumption of the rising and setting of the heavenly bodies being an appearance, caused by their becoming visible and invisible in turns when having approached us or receded from us by a certain amount, seems to have lead to the conclusion that the light of the one sun and the one moon appearing to us cannot illumine the whole vast earth, since it only reaches to a certain limited

[•] For the particulars mentioned in the following: comp. Mullach's collection of the fragments of the Greek philosophers, Zeller's history of Greek philosophy, Lewis's historical survey of the Astronomy of the Ancients.

distance.—On the other hand it is true enough that, notwithstanding these similarities of Indian and Greek ideas, books of the nature of the Súryapra-jūapti serve clearly to show the difference of the mental tendencies of the two nations. Both in an early age conceived plausible theories, in reality devoid of foundation, by which they tried to account for puzzling phenomena; but while the Greeks controlled their theories by means of continued observation of the phenomena themselves and replaced them by new ones, as soon as they perceived that the two were not in harmony, the Hindus religiously preserved the generalisations hastily formed at an early period, and instead of attempting to rectify them, proceeded to deduce from them all kinds of imaginary consequences. The absurdity of systems of the nature of the Jaina system lies not in the leading conceptions—these can as a rule be accounted for in a more or less satisfactory manner—but in the minute detail into which the followers of the system have without scruple and hesitation worked it out.

Before this paper is brought to a conclusion, the writer wishes to draw attention to the-in his opinion very striking-resemblance which the cosmological and astronomical conceptions, contained in an old Chinese book, bear to the early Indian ideas on the same subject, more particularly to the Jaina system as expounded in the Súryaprajñapti. The Chinese book alluded to is the Tcheou-Pei of which a complete translation was published for the first time by Edward Biot in the Journal Asiatique for 1841. pp. 592-639. It consists of two parts of different ages; the first part which apparently is of considerable antiquity, has been known since the time of Gaubil, who inserted a translation of it into his history of Chinese astronomy, published in the Lettres éd fiantes; that part, as is well known, shows that the ancient Chinese were acquainted with the theorem about the square of the hypothenuse of a right-angled triangle. The second and more recent part, which E. Biot thinks cannot be later than the end of the second century of our era, contains a sort of cosmological and astronomical system, and here the traits of resemblance alluded to above are to be found. the arrangement of topics in the Tcheou-Pei is by no means systematic, so that it is not easy to form a clear conception of the essential points, a short abstract of the work, as far as it lends itself to a comparison with the Jaina system, is given in the following.

According to the Tcheou-Pei the sun describes during the course of the year a number of concentric circles of varying diameter round the pole of the sky. On the day of the summer solstice the diameter of this circle is smallest; it then increases during the following months, up to the day of the winter solstice when it reaches its maximum. Beginning from this day the solar circles again decrease, until on the day of the next summer

solstice they have reached the original minimum. On the day of the winter solstice the diameter of the solar circle amounts to 476,000 li (the li is a certain Chinese measure of length); its circumference to $3 \times 476,000 = 1,428,000$ li. The corresponding numbers for the circle, described on the day of the summer solstice, are 238,000 and 714,000. Between the innermost and the outermost circle there lie five other circles, which the sun describes in the months intervening between the two solstices, so that there are altogether seven circles; the six intervals between these are said to correspond to the months of the year $(2 \times 6 = 12)$. So it appears that the Tcheou-Pei assumes separate solar circles for each month only, not for each day. Each circle is at the distance of 19,833\frac{1}{2}\$ li from the two neighbouring circles.

The terrestrial place for which all the calculations of the Tcheou-pei are made is said to have such a situation that it is distant 16.000 li from the spot lying perpendicularly under the sun on the day of the summer solstice and 135,000 li from the spot lying perpendicularly under the sun on the day of the winter solstice; the distance of the place of observation from the pole, i. e., the spot at the centre of the earth which lies perpendicularly under the celestial pole, is said to amount to 103,000 li. Round the terrestrial pole there extends a circle of 11,500 li radius, which is the terrestrial counterpart of the circle described by the polar star round the celestial pole. The light of the sun extends 167,000 li in each direction, so that on the day of the winter solstice when the sun moves in the exterior circle it extends at midday only 32,000 li beyond the place of observation and so does not reach up to the polar circle. On the days of the two equinoxes when the sun is moving in the fourth circle—the diameter of which amounts to 357,000 li-the rays of the sun just reach up to the polar circle. On the day of the summer solstice when the sun moves in the interior circle his rays reach beyond the pole to the extent of 48,000 li. so that then the whole polar circle is continually illuminated. sun in his daily revolution has reached the extreme north point, it is midday in the northern region and midnight in the southern region; when he has reached the east point, it is midday in the eastern, midnight in the western region; when he has reached the south point, it is midday in the southern, midnight in the northern region; when he has reached the west point it is midday in the western, midnight in the eastern region. As the light of the sun always reaches 167,000 li each way, we must add 2 × 167,000 to the diameter of the circle, described on the day of the winter solstice, in order to obtain the diameter of the circle representing the outmost limit reached by the rays of the sun; the diameter of this circle is therefore 810,000 li.

On the day of the winter solstice the space illuminated by the sun

stands to the space not reached by his rays in the relation of three to nine; this proportion is to be reversed for the day of the summer solstice. The day of the winter solstice is the shortest during the year; the day of the summer solstice the longest. On the day of the winter solstice the shadow of the gnomon is 18.5 feet long; beginning from this day it goes on diminishing by equal quantities during equal spaces of time up to the day of the summer solstice when its length is reduced to 1.6 feet. It then increases again in the same uniform manner up to the day of the next winter solstice.

The circumference of the sky is divided into twenty-eight stellar divisions of unequal extent, through the circle of which sun and moon are performing their revolutions. Kien-nieou is the asterism in which the sun stands at the winter solstice; Leou the asterism of the vernal equinox etc. A procedure is taught how to find the place of the sun at any time. The whole circle of the asterisms is divided into 365½ degrees corresponding to the number of the days of the year. A year is the period which the sun requires for returning to the same star from which he had set out. The meeting of sun and moon constitutes a month. A period of nineteen years of 365½ days each contains 235 lunations. Arithmetical rules are given how to find the place of the moon at the beginning of each year etc.

The Tcheou-pei contains some additional matter about observations of the polar star etc., but by far the greater part of the topics it treats have been touched in the above summary. The similarity of this system and the old Indian systems particularly, as far as some details are concerned. the Jaina system is obvious. The same supposition is made use of in both to account for the alternating progress of the sun towards the north and the south. In the Jaina system the sun revolves round Mount Meru, in the Chinese system, to which the idea of a central mountain seems to be foreign, round the pole of the sky; Mount Meru finds, however, a curious counterpart in the Chinese polar circle, the projection of the circle described by the polar star. Both systems state the dimensions of the circles described by the sun; both state in figures the extent to which the rays of the sun reach. Both hold the same opinion about the alternation of day and night in the different parts of the earth. Both are interested in finding out what places sun and moon occupy in the circle of the nakshatras. Both teach the increase of the shadow by an equal quantity in each month. On the other hand there are important points in which the two systems differ. The Chinese appear from comparatively ancient times to have had a knowledge of the fact that the approximate duration of the solar year amounts to 3654 years and that a period of nineteen years comprises 325 lunations. This of course makes the system of the Tcheou-pei to differ from the Jaina system in all those details which depend on the fundamental period and the advantage is of course altogether on the side of the Chinese. On the whole the Tcheou-pei is much superior to works of the stamp of the Súryaprajñapti, as in midst of all the fantastical and unfounded ideas it contains there are found some positive elements, observations of stars which admit of control etc., features altogether absent in the Súrya-But in spite of these points of difference the similarities of the two works remain striking, especially if we take as one member of the comparison not the Súryaprajñapti itself but some hypothetical older work of the same class, less elevate and more moolerate in the statement of dimensions, figures etc. That such works if not existent at present must have existed at same earlier period is manifest from the remarks the Súrvaprajnapti in many places makes about the opinions of other teachers. several of which have been extracted above. That two different chronological periods, the quinquennial yuga and so called Metanic cycle, from the foundation of the two systems does after all not interfere very much with their similarity. We might imagine the Jainas adopting the more correct cycle of nineteen years instead of the quinquennial one and work out all the new details necessitated by such a change, calculate all the places of moon and full moon during nineteen years instead of five etc., nevertheless the new system would immediately suggest the idea of the old one. An essential feature in the resemblance of the Chinese and the Hindu system is more over the circumstance of both limiting themselves to the treatment of a certain number of topics. The following paragraph of the Tcheoupei (p. 603) which shortly states the questions to be treated in the work, might with hardly any change be taken as a summary of the contents of the Súryaprajñapti.

"I have heard people speak of the knowledge of the great man. I have heard it said that he knows the height and the size of the sun, the extent which his light illuminates, the quantity by which he moves in the course of one day, the quantity be which he recedes and approaches, the extent which the eye of man embraces, the position of the four extreme (cardinal) points, the divisions of the stars arranged in order, the breadth and length of the sky and the earth."

The question whether the similarity of the two systems justifies us in assuming a historical connexion between the two or would be an interesting one, but cannot be treated in this place, especially as its solution could only be attempted together with the solution of a number of cognate problems.

Coins supplementary to Thomas' "Chronicles of the Pathán kings of Delhi."—By Chas. J. Rodgers. (With a Plate.)

Steady research is always followed by constant results. These results are as a rule insignificant discoveries which are individually small, but collectively they all go to swell the sum of human knowledge. In my last small supplement to Thomas' "Chronicles of the Pathán kings of Delhi" I promised to give some additions which I had then in hand. But as I went on with two other papers and my researches for them, I found that incidentally my matter for the second supplement grew more interesting, and at last I found to my surprise that I had more coins in hand than would fill two plates; so I began to draw at once and simultaneously to put away for a third supplement all coins for which I could not now find a place. Strange to say just as I had made up my mind about these plates a find of about 500 coins of five Ghazni kings, all struck at Lahore, came to hand, some quite new and unpublished, and after that a batch of silver coins of Ala-uddin Khwarizmi of whose coins I gave three new types in my first supplement and of whose I give one great beauty in my present paper. These silver coins were struck at Ghazni and Furnoin or as Thomas calls it 'Perwan.' He gives no drawings of them and only alludes to them as giving us the mint of Perwan. Charní kings' and the Khwarizmi king's coins must stand over for the present. I scarcely dare make a promise about them. About a year ago I came across a find of Ghazní coins, in number about 500, and up till now I have had no time to work at them and say what was in them, although there were several novelties of historic value. As I personally go to the bazars I see for myself what comes into them. And when I see what comes into them and what finds a lodgement in our museums, I am astonished and dumb-foundered to think that coins of whose existence we are unaware are daily being brought in from the villages and fields and ruins which abound here and there in the country and are simply handed over to the smelting pot as common silver,-bullion in fact which is purchased at a little less than its intrinsic value. And all this, while there is in India no Imperial Cabinet of Coins and no one appointed to collect for it and arrange it and make it a thing worthy of the historical associations. India as an Empire and as a collection of ancient kingdoms and states, India is a continent: but it is too poor to possess one Imperial Cabinet of coins which would serve as a metallic record of past emperors and rulers, past glories and shames, in fact, which would be a history of the past in metal manuscripts. With the present rage for melting down

everything it is high time something were attempted. Our only relics will soon be empty, worn out, burnt up smelting pots.

In the present supplement the coins I give are chiefly varieties of coins already known. The inscriptions are sometimes longer than those given in Thomas: sometimes they correct his readings; sometimes the coins reveal new mints, sometimes they are quite new types of coins.

Plate I, No. 1. Obv. Túj ud daulat Khuerau Malik.

Rev. Bull with new mark on its jhul.

This coin is quite a new type of Khusrau Malik's coins.

- No. 2. Obv. (As sultán ul) Azim Túj ud Daulat Khusrau Malik. Rev. Bull with new mark on its jhúl.
- No. 3. Obv. (Us sultán al) Azim Rukn ud dunyá wa ud Dín Féroz (Sháh).

Rev. Remains of a horseman and his steed.

Thomas gives three coins belonging to this king (Pl. I, fig. 24, 25, 26). I ascribe these three to Rezia. The Rukn is unmistakeable in my coin. I give in No. 4 a drawing of a coin I have, which is exactly like one of Thomas' (No. 24). A careful study of it will at once show that it reads Obv. "Us sultán al Muazzim Rezia ud Dunyá wa ud Dún." Rev. Horseman and steed, exactly like Thomas'. In my coin the zwád (i) is more fully developed and it must be a coin of Rezia's.

In Pandit Ratan Narain's list of coins I find a rupee of Rukn ud Din Firoz Sháh's. Obv. As sultán ul 'Azim Shams ud Dunyá wa 'd Din, abú'l Muzaffar Rukn ud Dunyá wa 'd Din Firoz Sháh. Rev. Fi ahd il Imám Al Mustansir, Amír ul Mominín, fi shahúr i san thaláth wa thaláthín wa sita mi'ata. In this rupee the letters of Rukn are exactly as in my coin. It has no margins, the date is given in the square area. This rupee is quite unique. I should very much like to know its whereabouts. Such a coin should by no means leave the country. I may add that Ratan Narain gives in his list a copper coin like mine, and, being misled by Thomas, gives also two of Rezia's coins as Rukn ud Din's. I have four coins of Rezia's of this kind, as well as four of the type I published in my last paper, and one each of Thomas' Pl. I, figs. 28 and 29. On comparing them I have no hesitation whatever in assigning Thomas' Pl. I, Nos. 24, 25, 26 to Rezia.

In my last paper I gave a coin of Sanjar and Bahrám Sháh. In it the title of *Muazzim* was given to Sanjar. In my present paper I give coins which shew that this title was given to several kings, who rejoiced however, as is shown by their numerous coins, in the title al Azim.

- No. 5. Obv. "As sultán ul Muazzim, Alá ud Dunyá wa 'd Din."
 Rev. Horseman and steed.
- No 9. Obv. As sultán ul Muazzim Eltatamsk as Sultán. Rev. Horseman and steed and remains in Hindi of Srí Hamírak.

Plate II, No. 2. Rev. Us sultán ul Muazzim.

Obv. Gyás ud Dunyá wa ud Dín.

In these three coins Alá ud Dín (Masaud Sháh) and Shams ud Dín Altamsh and Gyás ud Dín (Balban) we have the title Muazzim. comes also in No. 6 which I now proceed to describe.

- No. 6. Obv. in florid Kufic "As sultán ul Muazzim Shams ud dunyá wa'd din Abu'l Muzaffar (Eltamach?). Rev., in a rayed circle, the Kalimah, under which (Al Mustansir) biamri 'llah Amír ul Mominín. This coin weighs 62 grs. only. It is therefore a tankah. It came to hand with three Bahá ud Dín Sám's silver tankahs.
 - No. 7. A rupee of Shams ud Din Altamsh.
- "As Sultán ul Azim Shame ud Dunyá wa 'd Din Altameh as Bultán Násir i Amír ul Mominín." Rev. Fí ahd il Imám Al Mustansir Amír ul Momanín. Margin illegible alas!
 - No. 8. Obv. in Hindí above bull, Samasa Dín.

Rev. above horse Ha and no other letter of Hamirah.

This type is quite new.

No. 10. Obv. As Sultán ul Azim Shams ud Dunyá wa 'd Dín.

Rev. Horseman, to right of which Eltatamsh, and above horseman se Sultán. Thomas' coin had not any inscription in front of the horse. I have seen several of this type.

- No. 11. Obv. (Shame) ud Dunyá wa (ud Dín) Eltatameh as Sultán. Rev. Horseman and Sri Hamirah.
- No. 12. Obv. As sultán ul 'Azim Eltatameh as sultán. Rev. Horseman at charge.

No. 13. Obv. Shams ud Dunyá wa 'd Dín Abú 'l Muzaffar us Bultán.

Reverse, not given.

These three coins Nos. 11, 12 and 13 give more than do Thomas' Nos. 47, 46, and 48. A comparison of them with Thomas' coins will at once show the additional information these supply.

This is the same as Thomas' No. 50, with the addition of the word as Sultán on the obverse plainly visible.

Nos 15, 16, 17, 18 show at one view four types of coins of Elduz, the general of Muhammad bin Sam. Three of them are binominal.

No. 15. Obv. Muizz ud Dunyá wa'd Dín, Abd Yalduz.

Rev. Bull over which "Sri Muj," in Hindi.

There cannot be much doubt about the reading of the Hindí. Hamírah it cannot be. It is an attempt I think by a Musalmán at Srí Muizz.

No. 16. Obv. Muizz ud Dunyá wa 'd Dín. Rev. Abd Yulduz.

There are floral ornaments about the inscriptions.

No. 17. A similar coin to Ariana Antiqua, Pl. XX, fig. 18, but much fuller.

Obv. " As Sultán ul Azim Muizz ud Dunyá wa'd Dín."

Rev. 'Abdu 'l Malik ul Muazzim, Táj ud Dunyá wa 'd Dín Yalduz.

No. 18. Obv. "As sultán ul. Muazzim Abú' l Fath Yalduz as Sultán.

Rev. Horseman with remnants of Sri Hamirah and Star underneath horse.

Plate II. No. I. Gold Mohur of Sher Sháh. Obv. in Mahrábí area "As Sultán Sher Sháh, khallad Allah Mulkahu." Rev., in square area, the Kalimah. Both margins are illegible: this is a great pity, as the coin is in every other respect one of great beauty.

No. 3. Obv.—" Sultán Sher Sháh, zarb i Sambhal." Margin obliterated. Rev. not given.

No. 4. Obv.-" Sultán Sher Sháh, zarb i Alwar."

These are two new mints of Sher Shah.

No. 5. Rupee of Sher Shah. Circular areas on both sides. Obv. "Sher Shah Sultan, khallad Allah &c.

Margin:—" Farid ud Dunyá wa'd Din abú'l Muzaffar" and in Hindí, Sher Sháh, and in Arabic figures 949. Rev. the Kalimah: Margin, the names of the four companions: and "As Sultán ul Adil, zarb Ujain. This is also a new mint of Sher Sháh's.

No. 6. Rupee of Sher Sháh's: Square areas surrounded by double lines.

Obv. Sher Sháh Sultán, khallad Allah mulkahu." Margin "Farid ud Dunyá wa'd Dín, zarb i Shergarh, in Hindí "Sher Sháhi."

Rev., kalimah in area. Margin, the names of the four companions and their titles. This coin has not been figured before. Unfortunately mine has lost a piece out of its centre and it has not been mended very cleverly. But the workmanship is very superior.

No. 7. Rupee of Kutub ud Dín Mubárak Sháh. New type.

Obverse: "Al Imám ul Azim, Kutub ud Dunyá wa 'd Dín, Abú 'l Muzaffar, Khalífatu'lláh."

Rev. central area: "Mubárak Sháh as Sultán, ibn us Sultán Al Wásiq billah, Amír ul Mominín."

Margin.—" Zarb házá il Fizzat bi Hazrat dár il Khiláfat, Fí sanat, saba ashrata wa saba míata.

This coin has on it exactly the same as Thomas' No. 146. But his is a square piece. On Mr. Delmerick's coin are similar inscriptions, with the mint place however termed "dár ul mulk," not "dár ul khiláfat."

No. 8. Gold coin of Gyás ud Dín Tuglaq. This coin is the same as Thomas' No. 158. In his coin the margin stops short when it gets to the mint. This goes on three words "fi mulk i Talang." It was struck in Telingana.

No. 9. A gold mohur. Rev. Mahmúd Sháh, bin Muhammad Sháh bin Tuqlaq Sháh as Sultán 752."

Obv. Fí zaman i Amír ul Mominín, Gyás ud Dunyá wa 'd Dín, Abú 'l Muzaffar."

When Muhammad Tuglaq died, Fíroz Sháh was with him at Tatta in Scinde. Ahmad Ayáz Khwájah i Jahán set up in Dehli a boy of six years of age as king. Ferishta says that he was called Gyás ud Dín *Muhammad*, but the coin shows that his name was *Mahmúd*. On Fíroz Sháh's arrival in Dehli Mahmúd was deposed.

No. 10. New type of Alá ud Dín Khwárizmi's coin struck at Kishm. Obv. "Kishm, Ala ud Dunya wa'd Dín, Muhammad bin us Sultán." Rev. horseman by side of spear "(A)mír." Above the horse "ul Azim."

No. 11. Obv. " (Saif) ud dunyá wa 'd Dín, Abú ul Muzaffar, al Ham, bin Muhammad."

Rev. Bull on which "Kirmán," over it in Hindí Srí H?"

No. 12. Obv. " Násir ud dunyá wa 'd Dín, Abú 'l Muzaffar.

Rev. "Muhammad bin Hasn Karlagh."

No. 13. Obv. in Hindí round a bull " Srí Jalál ud Dín." On the bull in Arabic " Kirmán."

Rev. Horseman over which words which may be Hindi "Sri Hami-

These last four coins are all new types. Kirmán* may be the Persian province and town. Jalál ud Dín Khwárizmí went there by way of Mekrán after he left India. At least so says the author of the "Rauzat se Safa."

No. 14. Obv. "Khalifatu Rabb il Alamín Kutub ud Dunyá wa'd Dín."

Rev. "Abú'l Muzaffar Mubárak Sháh as Sultán ibn us Sultán Al wásiq billah."

No. 15. Obv. "Al Mujáhid fi sabíl i 'llah Muhammad Tuglaq."

Above, "Abubakr;" to right, "Alí;" to left "Umr" under "Othmán."

Rev. the Kalimah in a circle. Margin: "Zarb házá us Sikka, bi Hazrat Dehlí, fi sanat Khams asharín wa saba míata. This coin is a very

• Thomas identifies it with Kurrum near Bunnu. Kishm is I suppose the island and town at the entrance to the Persian Gulf. If so, there is no reason why Kirmán should not be the Persian one, except this one, that here we have coins struck in Hindí.

much better specimen than the one given in Thomas which was struck in Dár ul Islám." Thomas calls his unique, but I have one also struck at "Dár ul Islám," and during the last five years I have seen about half a dozen of them. Dehlí and Dár ul Islám were favourite mints of Muhammad Tuglaq, but I have coins of the type of No. 159 in Thomas that were struck at not only these two places, but at "Takhtgáh i Dehlí," "Arsa i Satgáwn," and at "Iqlím i Tuglaqpúr urf (known = i. e.) Tirhut." There are coins extant which were struck at Daulatábád. Thus there were six mints of this one type of coins. The simply Dehlí marked coins and the Tuglaqpúr and Satgáwn types have not yet been published. Thomas' No. 173 was struck at Dehli. The Lahore Museum possesses three similar gold mohurs. Of these, two were struck in 734 and one in 735 and all at Satgáwn in Bengal.

In Sir Alexander Burnes' "Travels in Bukhara" Vol. II, two plates of coins are given. This book was printed in 1834. Masson's researches in Afghanistán produced over 60,000 coins. From them Wilson compiled the Ariana Antiqua which contains 21 plates of coins, Grecian, Greco-Bactrian, Indo-Scythian, Sassanian and Indian. General Cunningham in his "Coins of the Successors of Alexander in the East" gives fourteen plates which deal only with Grecian and Greco-Bactrian coins. Late discoveries have produced so many new coins that a supplement equal in size to the original book might easily be published. The coins of each dynasty that has reigned in India supply matter enough for a volume. These coins are purchased by private individuals and of course kept in their cabinets, each new type being hailed with numismatic delight. When these private individuals go home, of course they take their acquisitions with them. So that private enterprise in Indian numismatics simply robs the country of its treasures. When a poor student wishes to see the coins about which he reads, he cannot do it. The museums have not got them. The Calcutta Museum is I am credibly informed destitute of coins. It seems to me there is only one way of meeting this difficulty. The Museums of India must have grants made to them for the purchase of coins just the same as Museums at home have. The Berlin museum gets everything good in Europe, simply because it gives good prices. Here in India those who can pay get the best coins. And if the Government of India desires that the museums should possess cabinets of coins, men must be appointed and money granted, or nothing will ever be done except opportunities lost.

I have shown above how our knowledge of the different kinds of coins has increased. What I desire to see is an increase in the number of coins in our museums.

Copper Coins of Akbar. By CHAS. J. RODGERS, Amritsar.

(With two Plates.)

In this paper I propose first to make a list of the coins I have drawn in the two plates accompanying this paper and secondly to offer a few remarks which seem to suggest themselves from a study of the inscriptions on the coins.

```
No. Wt. in grs.
           Obv. Do tánke i Akbar Sháhí.
     108
           l Rev. Zarb i Agrah, (Shahrewar?) 50 Ibahi.
           SObv. Do tánke i Akbar Sháhí.
 2
     109
           l Rev. Zarb i Agrah, Azr 46 Ilahi.
           (Obv. Yak tánke i Akbar Sháhí.
 8
       59
           l Rev. Zarb i Láhor (?) 46 Ilahí.
           (Obv. Dám.
 4
       76
           Rev. 33 Ilahí.
           Obv. Zarb i Fulús i Nárnol.
 5
     326
           Rev. Fi san i Nuhsad wa shast, 963.
           (Obv. Zarb i Fulús i dár us saltanat, Ahmadábád.
 6
     318
           Rev. Fí san i Nuhsad wa hashtúd wa shash.
            (Obv. Zarb i Fulús i Dehlí.
 7
     311
           Rev. Nuhsad wa hashtád wa yak.
           Obv. Zarb i Fulús i Dár us saltanat, Fathpúr.
 8
      319
           l Rev. Fí san i nuhsad wa hashtád wa nuh, 989.
           6 Obv. Fulús i Dár us saltanat Láhor.
 9
      325
           Rev. Fí san i nuhsad wa hashtad wa haft, 987.
           (Obv. Zarb i Fulús i Hissár Firozah.
10
           ] Rev. Fí san i nuhsad wa nawad wa shash, 996.
           (Obv. Fulús i Dár ul Khiláfat, Lakhnau.
11
      817
           l Rev. Fí san i nuhsad wa hashtád wa nuh, 989.
           (Obv. Urdú Zafarfarín.
12
      821
           Rev. Zarb i Fulus. Alif = 1000 A. H.
           (Obv. Zarb i Fulús i Láhore.
13
      317
           l Rev. Farwardín, 39 Ilahí.
             Obv. Zarb i Fulús i Multán.
14
      812
           Rev. Urd i bihisht, 41 Ilahí
           (Obv. Zarb i Ilahábás.
15
      318
           l Rev. San i, 36 Ilahí.
           (Obv. Zarb i Fulús i Dehlí.
16
      308
           l Rev. Farwardín, 38 Ilahí.
            ( Obv. Zarb i Fulús i Urdú i.
17
      315
           l Rev. Zafarfarín, 42 Ilahí.
           (Obv. Zarb i (Gobi)ndpur, Sikka i Akbar Sháhi.
18
      827
           Rev. Urd i Bihisht, 46 Ilahí.
           (Obv. Dokání? or Dogánw? Sikka i Akbar Sháhí.
19
      815
           l Rev. Urd i Bihisht, 44 Ilahí.
      D D
```

```
No. Wt. in grs.
              Obv. Zarb i Fulús i Attak Banáras.
20
       316
            l Rev. Amr Dád, 37 Ilahi.
             Obv. Zarb i Fulús i Láhor.
21
       295
             Rev. Shahrewar, 43 Ilahi.
              Obv. Zarb i Fulús i Láhor.
22
        39
                              - 38 Ilahí.
              Obv. Zarb i Fulús i Nárnol.
23
        37
            Rev. Nuhsad wa shast wa nuh.
              Obv. Fulús i Kábul.
24
       149
            Rev. San, 33 Ilahí.
            (Obv. Fulús.
25
       885
             Rev. Urdú zafarfarín.
             Obv. Zarb i Dár ul Khiláfat, A'grah.
26
       140
            Rev. Fí san i nuhsad wa shast wa.
              Obv. Damrí.
27
        40
             Rev. 33 Ilahí.
              Obv. Zarb i Dehlí, Sikka i Akbar Sháhí.
28
            Rev. Máh i zí, 43 Ilahí.
```

28a. The space between the two lines shows the thickness of No. 28.

It will be at once seen that each of these coins with the exception of No. 26, has its own designation upon it. Thus Nos. 1 and 2 are called do tánke pieces; No. 3 is a yak tánke piece. No. 4 is a dám. Nos. 5—17 inclusive and Nos. 22—25 inclusive are fulús pieces. No. 27, is a damrí. Nos. 18, 19 and 28 are called Sikka i Akbar Sháhí. The term fulús is applied to coins varying from 37 to 326 grains, one struck at Kábul weighing 149. The word falas in Arabic means want, indigence, hence fals or fils, a small coin, an obolus, money given to relieve poverty, or small change or copper, as we say in English.* Fulús is the plural of fals. The first coin I have seen with fulús upon it is dated 946 A. H. It is evident that a term used so loosely as is this one could never have been brought forward in accounts or revenue statements.

Again the sikka has three weights 625.5 grains and 327 and 315 grs. I have three which I have not figured which weigh little more than 37 grains each. Hence sikka could not well be used as a definite value.

We have left the dám, damrí and tánke. We know that the last of these was a name applied to coins from the time of Mahmúd of Ghazní. We know also that tánkes were of two kinds, silver and copper. The weights of tánkes varied as did also their values. The tánkes of Sikandar Lodí were of different mixtures of silver and copper. Sometimes they contained only a little more than a grain and a half of silver in each, sometimes as much as eight grains and sometimes as much as sixteen, seventeen or even thirty-two. Hence it is evident that such coins could

^{• [}This derivation is doubtful. For fals signifies a fish scale as well as a copper coin. Ed.]

not be used in revenue returns. It became incumbent on Akbar, therefore, when he made a demand from his ministers for revenue returns to fix a standard. The yak tánke i Akbar Sháhí seems to be such a standard value. In the Aín i Akbarí we are told that the dám was a coin of the value of five tánkes. And further we are told that there were forty dáms to the rupee. Hence we may judge that there were 200 tánkes to the rupee. Now the total revenues of Akbar are put down by Nizám-uddín at 640,00,000,000 tánkes. This at the rate of 200 to the rupee would be equal to 3,20,00,000 rupees or £3,200,000.

Now in our list of coins we have a dám which weighs only 76 grains. And Abúl Fazl gives Akbar's revenues as 5,67,63,83,383 dáms. Now if a coin of 59 grains is valued at 200 to the rupee, a coin of 76 grains would be worth about 160 to the rupee. According to this account Abúl Fazl's statement stands at about 3 krors 54 lacs of rupees or £3,540,000.

These statements are small compared with those arrived at by Thomas who makes the first equal to 32 millions and the latter to 16 millions, a discrepancy rather startling. And the magnitude of the sums is somewhat appalling. For when we turn to the prices of the produce of the land we are astonished to find that wheat sold for two maunds per rupee, barley at four maunds, mutton at about a fortieth of a rupee per lb. And we must remember that nearly all Akbar's revenues were from land.

Now if things sold so cheaply there must have been a vast amount of land under cultivation, in order to realize a revenue of £32,000,000, which is only a fractional part of the value of the whole of the crops. And India in those days must have been an enormously rich country, for Akbar had only a fraction of it in hand.

Thomas in his calculations does not give one coin of Akbar's. He gives statements from contemporary writers. These men were often wrong. Certainly five yak tánke pieces of 59 grains could not be equal to the dám of 76 grains.*

Akbar's copper coins seem to follow the copper coins of the Súrí dynasty. Sher Sháh put an end to a mixed currency. But on no one of Sher Sháh's copper coins have I as yet been able to find a coin-name.

Abúl Fazl's statement is for the year 1003 A. H. or Akbar's 40th year and Nizám-uddín's is for 1002 or for his 39th year. The dám I figure is for the 33rd year and the yak tánke piece is for the 46th year. It is quite possible that these values were those the authors had in view.

I leave this part of the subject. It is one of great importance and one on which authorities differ widely. If Akbar out of the portion of India which he conquered could realize three hundred years ago 32 millions sterling, he in fact realized more than the English Government of India now does. For if we take away from the revenue all the extra sources

[•] See note on page 191.

which have accrued to it since the time of Akbar we leave a much smaller amount for land revenue simple than that realized by the third Mogul. I strongly suspect that the whole of these returns are paper sums which were never realized.

Let us now look at some other features in the coins:—the mint towns claim a word. They are A'grah, Láhor, Nárnol, Ahmadábád, Dehlí, Fathpúr, Hissár Firozah, Lakhnau, Urdu Zafarfarín, Multán, Ilahábás, Gobindpur, Dogánw (?), Attak Banáras, Kábul, in all sixteen mints. I have in my cabinet some half dozen to-me-illegible mints more of Akbar. In the Lahore Museum is a great heap of Akbar's large copper fulús, as yet unarranged.

Nárnol is not given in Thomas, neither is Fathpúr or Dogánw or Gobindpúr. Fathpúr is Fathpúr Sikrí near Ágrah. It rejoices in the title of Dár us Saltanat on both gold and silver coins of Akbar. I have one rupee of Sháhjahán struck at the same place. Attak Banáras is undoubtedly Attock on the Indus; for interesting remarks on this place I must refer the reader to General Cunningham's Archæological Survey Report, Vol. II, pp. 93, 94.

The years and months deserve notice. No sooner had Akbar proclaimed the change in the year than he began to strike coins according to his new system. The coins of the year 30 Ilahi are very rare indeed. I have two rupees of that year but no copper coins. (This was the year of the change.) Akbar reverted to Kalimah rupees after this. His square rupees with alif (= in Arabic 1000) are somewhat common. They all have the Kalimah on them. I have two square rupees of 1000 and 1001, with the date in figures, and with the Kalimah on them. The months also figure on the coins. Thus we have Shahrewar, Azr, Furwardin, Urd i Bihisht, Amr Dád, and Zi, or six months out of the twelve on the few copper coins here put forward. In rupees I have all the months. 1 am going to try to complete one year, having already of some years four months. I suppose the dies used must have needed constant replacing. Some of them were very sharp and deep and would soon be the worse for wear.

Of some places I have only figured one coin. I have several of most of them. Thus of Narnol I have four and five of 963, and one of an illegible mint of 966. The whole of the 50 years of Akbar's reign are I believe obtainable in all the metals, gold, silver and copper. I have every year in rupees, except 965. During the last five years I have come across many modure of different years. Some of these are of rare beauty. Systematic research ought to bring these to light. The British Museum has dirhams of the Khalifahs which go year by year from the commencement of their minting to the time when they ceased striking. And what makes these series the more interesting is the fact that each mint is thus represented year by year, sometimes for nearly a hundred consecutive years. In India, one

object to be had in view is a complete series of coins of all the Sultáns whether Pathán or Mogul, and of the Mahárájahs and Rájahs. Another object should be series of local mints. Thus Lahore, from the time of Mahmúd of Gazní to that of the latter Moguls, was a very famous mint town. But in the museum of that city no attempt has been made to secure complete series of Lahore coins. Those of the early Moguls are of great beauty and deserve to be gathered. The large mohurs and square rupees of Jahángír struck at Lahore are most especially worthy of notice. Of course the price of such coins would amount to a large sum. But if a museum is worthy of being kept up, surely the things in it should be worth looking at. The coins in the Lahore Museum are now being catalogued, and when the catalogue is issued, the deficiencies and redundancies of the collection will be seen at once. It is to be hoped that when the deficiencies are made manifest, some attempt will be made to make them good.

For coins Nos. 1 and 3, I am indebted to Dav. Ross, Esq., Traffic Manager, Scinde, Punjab and Dehli Railways for permission to make copies of them. For permission to draw No. 28, I am indebted to Mr. Ibbettson, C. S. of Kurnál.

With respect to the fulús coins I may add that these are probably the the coins of which Bernier says that Aurungzíb had bags of 1000 peyssas ready for distribution. In a loose fashion the term dám seems also to have been given to the large fulús pieces. And generally we see that with respect to Akbar's copper coins there was a want of definiteness which precludes the possibility of arriving at exactness with respect to his revenues. For we must always remember that copper was the standard of value in Akbar's time.

Note.—There is some confusion in the names of the copper coinage of the East India Company. Accounts are kept in rupees, annas and pies. There are 12 pies to an anna. But on the quarter anna we have in Persian distinctly يماني والم والم والم يك باي والم يك باي والم يك باي والم يماني و

The modern pice weighs about 100 grains. Hence a rupee is worth about 6400 grains. If a dám weighed 320 grains and a rupee were worth forty dáms then in Akbar's time a rupee represented 12,800 grains. But if also the ddm weighed 80 grains only, and there were 160 of them, the same result is arrived at. Now nearly the same result is arrived at with reckoning the rupee to be worth 200 tankes at 60 grains each.

If the relative values of silver and copper were the same in Akbar's time as now, then taking our coins the tánke and dám at 60 and 80 grains we have 106 and 80 to the rupee respectively. Taking these values, which are probably the correct ones, the revenues of Akbar according to Nizám-uddín and Abúl Fazl are £6,000,000 and £7,095000 respectively.



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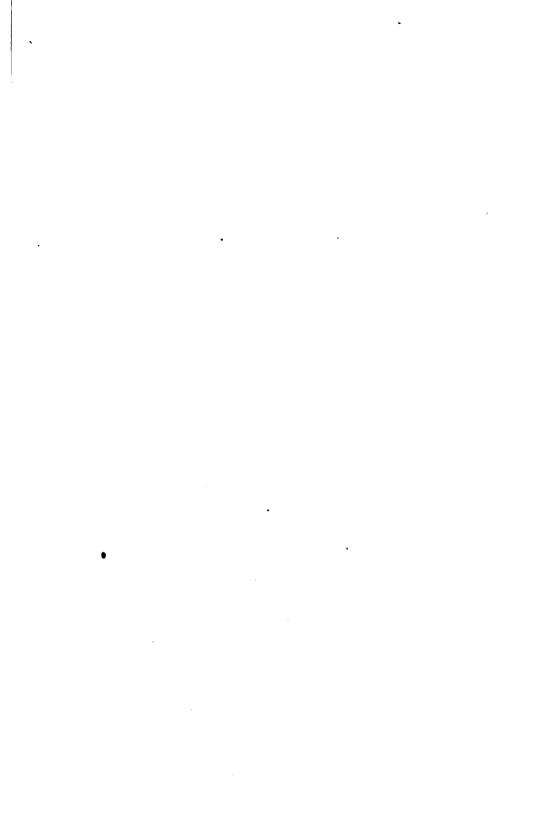
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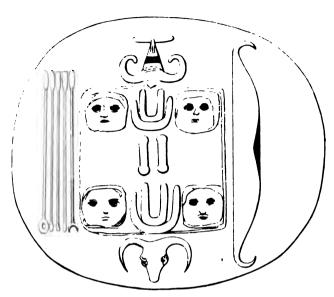
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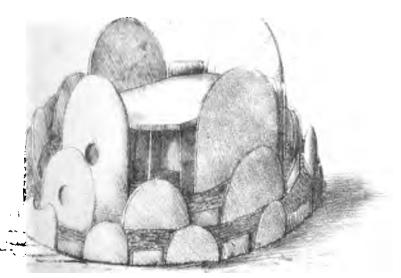
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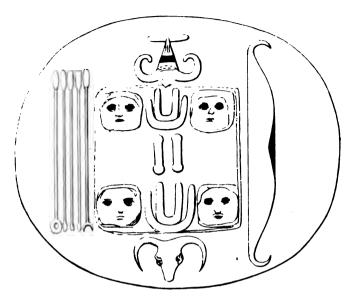


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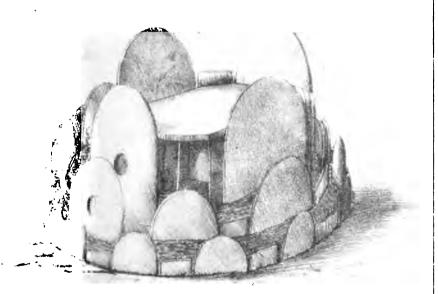


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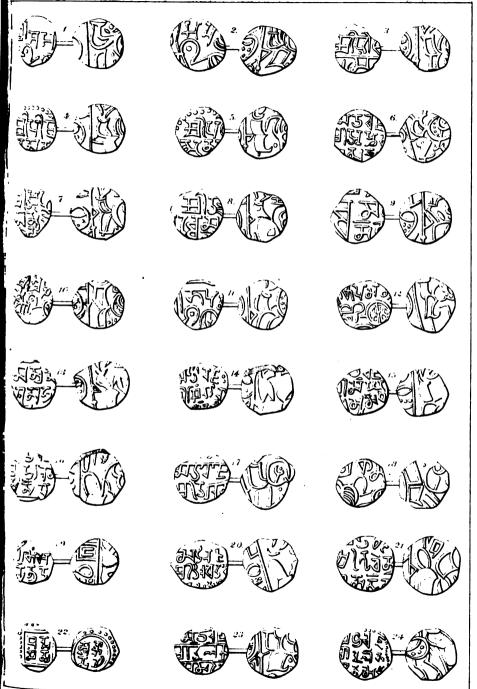
Rediy Kulptured (sacrificial) stone, lying before Temple of Kamala-kanni-y-amman at Chenji or Sanji-kôtlui ("Gingec") S. Arcot.



Ende repulchral monument of stone slabs at Iralabanda—Bápanattam, in North Arcot District of Madras.

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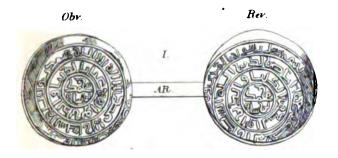


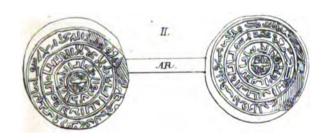
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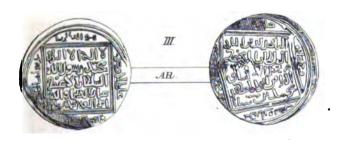


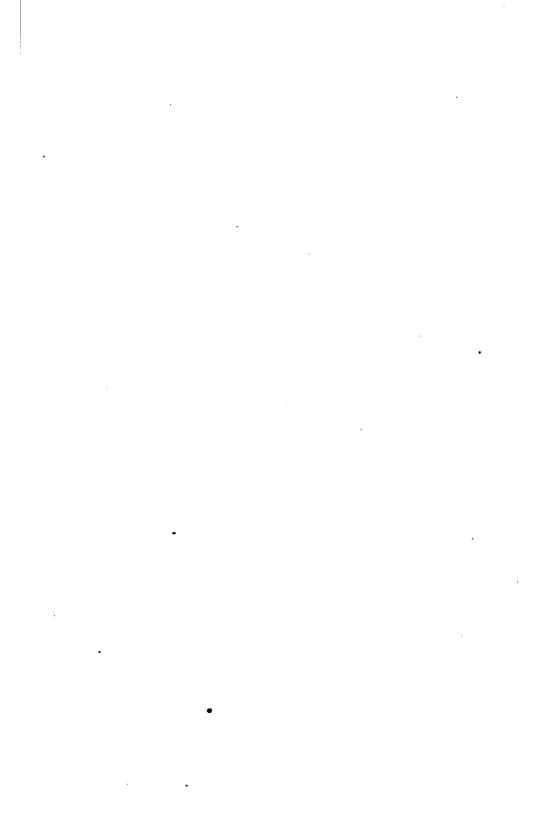




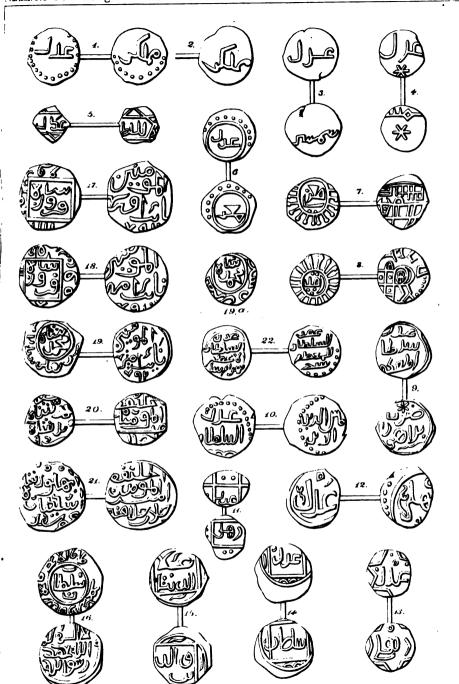


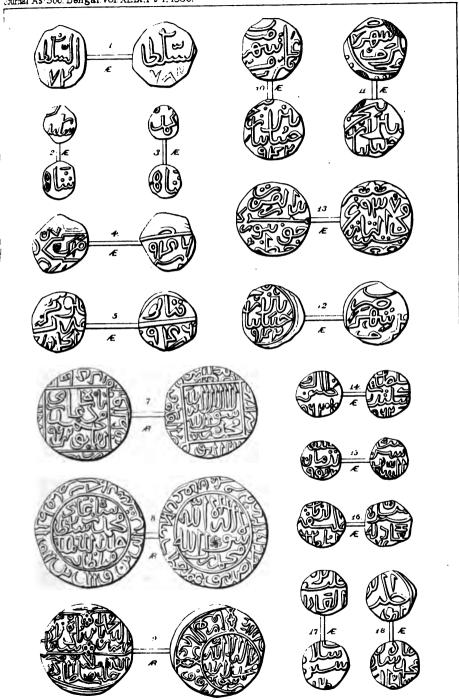


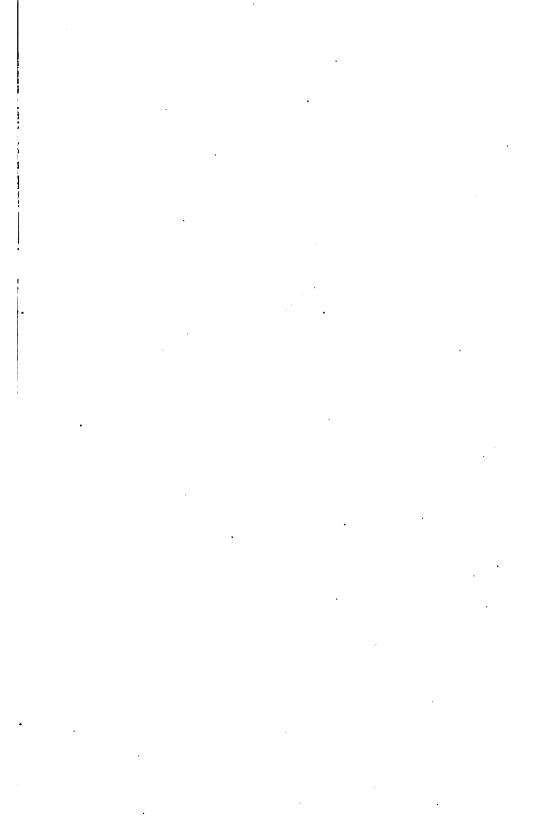




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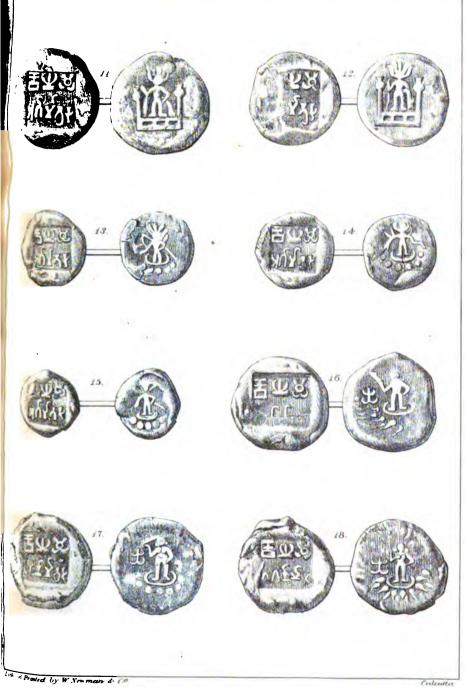




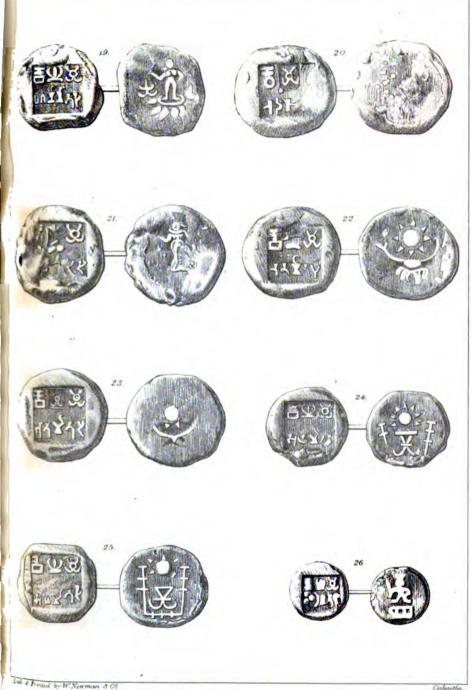




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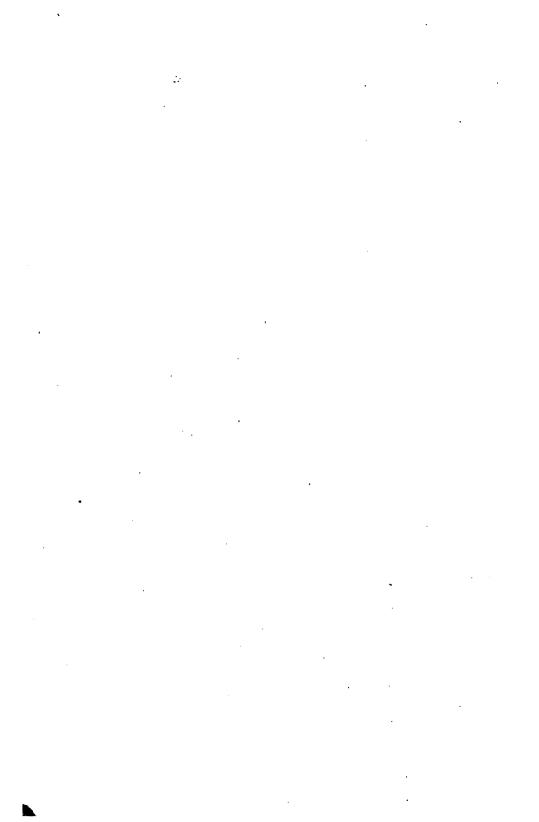


Fig. 9. Utmán Khél (Kákar) Hut. Ghazgai Valley. Ningsnd.

Fig. 10. Sandar Khél (Kákar) House. Bórai Valley. Wariágai.

Fig. 12. Sand Bóra

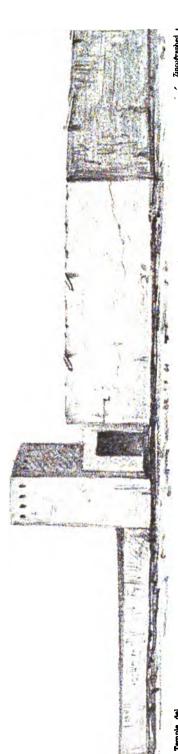
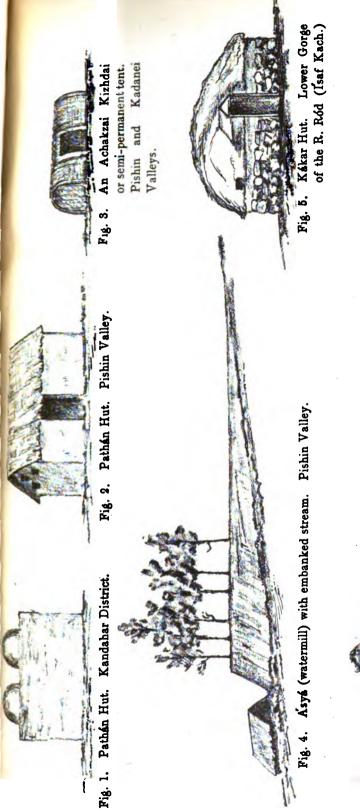


Fig. 11. Sandar Khél (Kákar) House. Bórai Valley. Warisgai.

SKETCHES FROM AFGHANISTAN.





Shór Valley. Chimján. (Kakar) Zakhpél

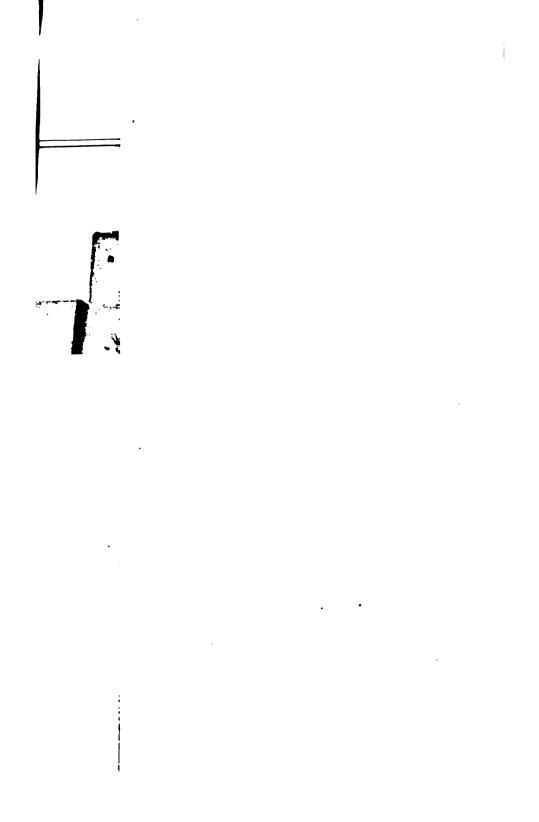
OFFITTER PROM ARCHANISTAN

from Khwára looking East. (No Scale.)

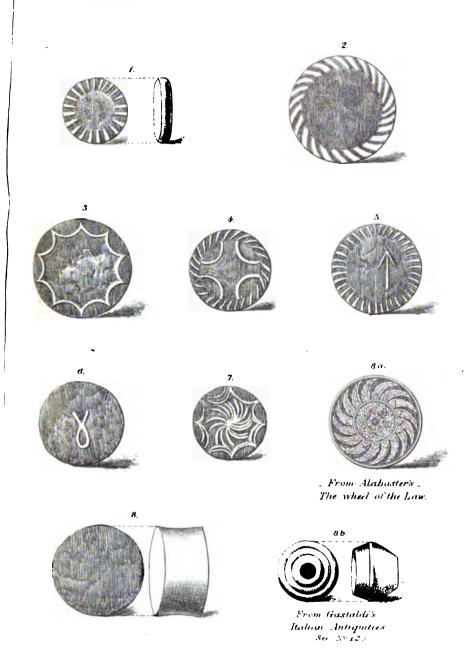
Fig. 7. Mt. Syajgai, 9,000 feet (a landmark in the Shór Valley, near Chimjan)

Kákar Hut. Upper Gorge of the R. Ród (Zagan Kach.)

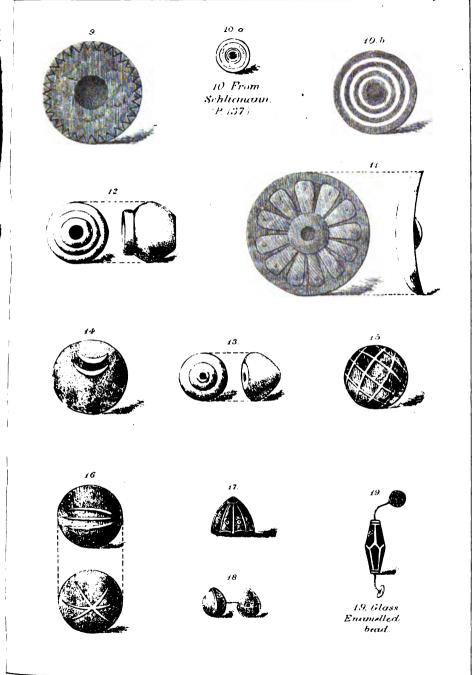
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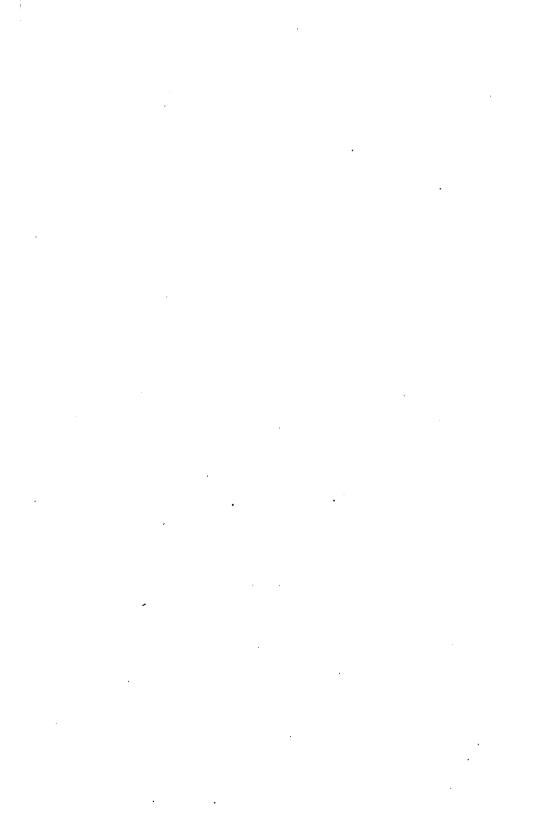
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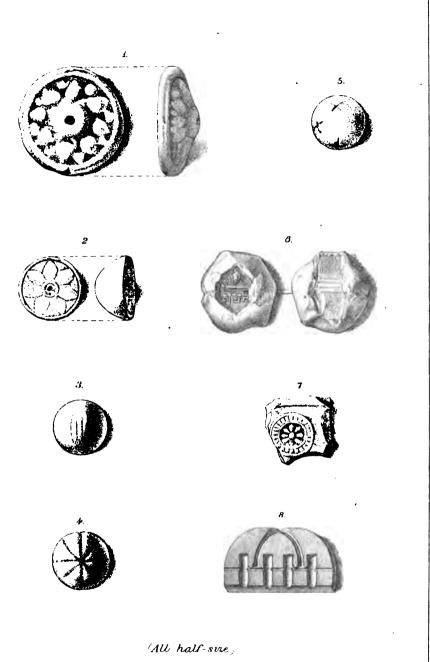
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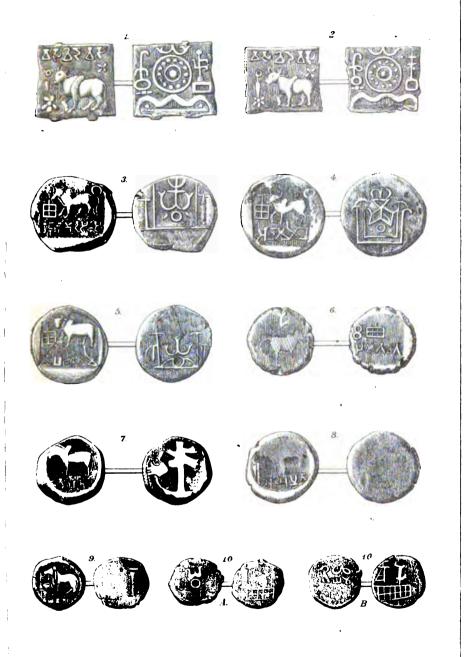


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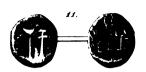
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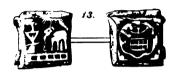
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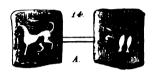


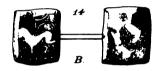


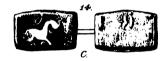


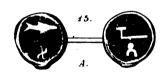


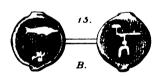


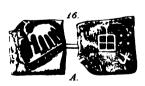


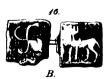


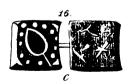




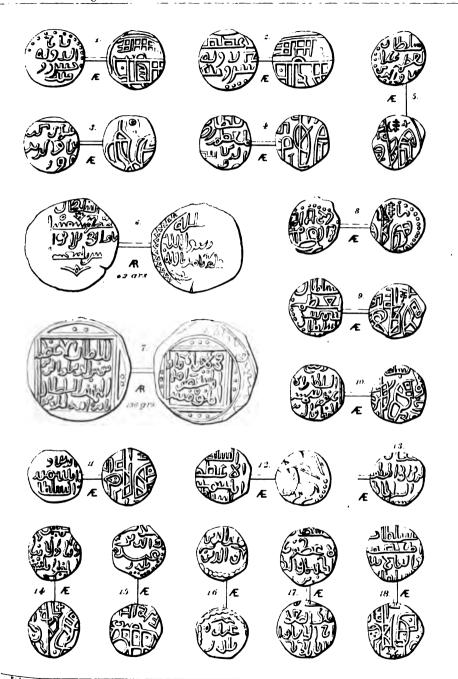






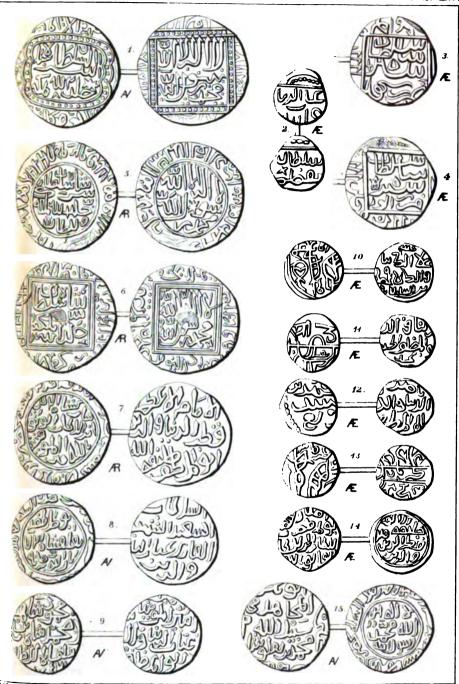


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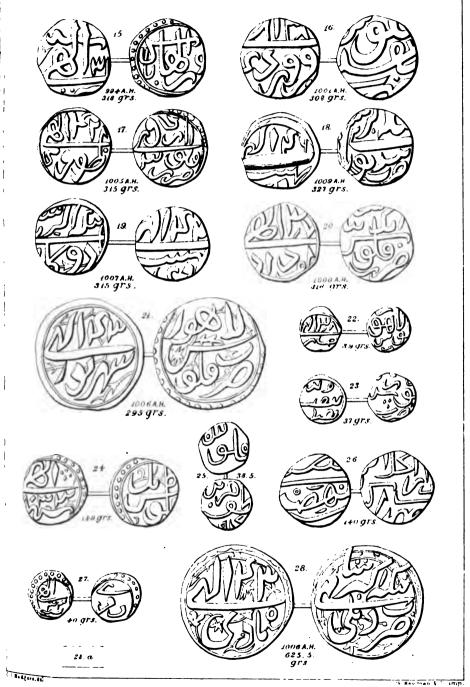


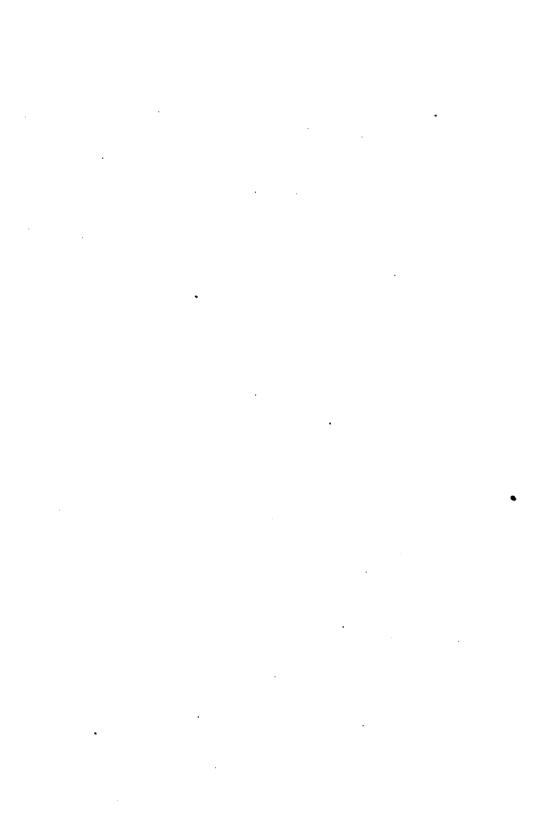
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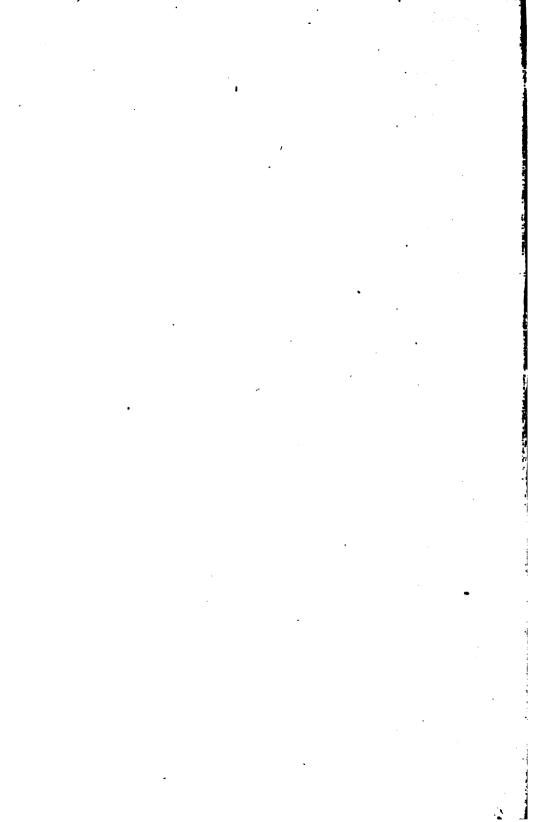


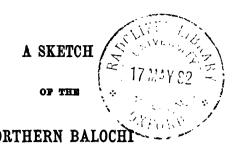




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LANGUAGE

CONTAINING

A GRAMMAR, VOCABULARY

AND

SPECIMENS OF THE LANGUAGE

BY

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INTRODUCTION.

- 1. The Balochi language belongs to the Iranian branch of the Aryan family. It is found in two distinct forms; the Northern dialect which is here treated of, and the Southern or Makráni dialect which has been lately dealt with in Major Mockler's Grammar. The Northern dialect is spoken among the Rind Baloches living in the neighbourhood of the Bolán Pass in Kachi, and on the Upper Sindh and South Panjáb frontiers. The tribes speaking this dialect are the Rinds, Dombkis, Maghasis, Jakránis. Marris, Bugtis, Mazáris, Drishaks, Gorchánis, Lasháris, Durkánis, Legháris, Hadyánis, Lunds, Khosas, Bozdárs, and Kaisaránis. These tribes come into contact with populations speaking Sindhí, Panjábí, Brahói, and Pashto. The Indian languages, Sindhí and Panjábí, have affected the Balochí Vocabulary considerably, Pashto very slightly if at all, while Brahói has probably borrowed considerably from Balochi. The Brahois commonly understand Balochi, and it is the commonest medium of communication between them and the Balochi speaking tribes. The best Baloch is probably spoken among the Dombkis and Bugtis, the most corrupt perhaps among the Bozdárs. But the differences in dialect between one tribe and another are very slight, while between the Northern and Southern dialects the difference is so great that the one is almost unintelligible to the tribes speaking the other. The Sarawán and Jahlawán tribes of Brahóis occupy a broad belt of country dividing one dialect from the other.
- 2. This dialect was first dealt with by Leech in the Journal of the Bengal Asiatic Society for 1840. His sketch was commented on by Lassen in the "Zeitschrift für die Kunde des Morgenlandes" for 1841. Leech gives a small Vocabulary. Gladstone's Bilúchí Manual (Lahore, 1873) and Bruce's Manual (Lahore, 1869) both include Vocabularies, but no attempt has hitherto been made to compile a full or systematical vocabulary. There is a scanty vocabulary of Southern Balochí in Masson's travels, but this dialect is fully dealt with by Major Mockler, and a vocabulary is also promised. The difference between the dialects is so

2

great however that Major Mockler's works are of small value to the student of Northern Balochi, which is of most importance politically speaking. Partly to supply this want, and partly as a contribution to the study of an interesting group of languages, I have compiled this vocabulary, for which I have been collecting words for four years on the Southern Deráját Frontier, and in the Sulaiman Hills, and for a short time in Sibi and Kashi.

- 3. Balochí is as regards vocabulary a mixed language. The original old Persian stock has formed the nucleus round which the alien elements have gathered. The principal borrowings have been from Sindhí or the South Panjábí dialect which is nearly akin to it. Correspondences are pointed out in the vocabulary, Indian words being generally marked as Sindhí, as that is the source from which they are immediately derived. But by pointing out the correspondence I do not mean to assert that in every case Balochí has borrowed from Sindhí. Sometimes Sindhí may be the borrowing language, and in many cases both languages are indebted to modern Persian or Arabic. Though the numerical proportion of Sindhí words as shown in the vocabulary may seem very large it is not so in actual practice, as many of these words are of rare occurrence, and others only locally used. Nearly all the words in commonest use, especially the verbs, are pure Balochí.
- 4. I prefix an outline of the grammar of Balochí. Lassen has already treated of the sounds, but the materials furnished him by Leech were too imperfect, and too full of misprints to be a safe foundation to build on in every case. Although, however, he was led astray in individual cases, the true character of the language did not escape him, and the remarks that follow are based on his.

BALOCHI GRAMMAR.

TABLE OF BALOCHI SOUNDS.

			SURI			SONA	NT.	-	nt.		te.
		Mute.	Asp	irate.	Mute.	Asp	irate.	Nasal.	Sibilant.	Semi- vowels.	Aspirate.
Guttural	•••	ک k	کهٔ kh	さ kh	ۍ g	گهه gh	غ gh	n n			s h
Palatal	•••	€ ch	chh		Ę j	جههٔ jh			ش sh ز zh	<i>ي</i> ۲	
Cerebral	•••	ţ	ٿهه th	•••	زة d r	ψp 2	- 		•••		•••
Dental	•••	t	تهه th	ئ t	s d	83 dh	s dh	ນ n	س s ز z	J 1 7	•••
Labial	•••	پ P	په ه ph	ن f	y b	بهة bh	و v, w	r m		•••	•••

THE ALPHABET.

Balochí can hardly be called a written language. It is only within the last few years that Balochis have begun to write it. Persian being the ordinary medium of written communication and the Balochis considering their language to be merely a colloquial form of Persian. uniformity of spelling is little attended to. As the Persian character is the only one current in the countries where Balochi is spoken, I have employed it in the Vocabulary, giving a transliteration of all words in the Roman character. Short vowels are not marked in the Persian character, as the transliteration renders it unnecessary. The Arabic letters 🛎 and S are retained to represent certain Balochi sounds corresponding, or nearly so, with their Arabic values, the representation of these sounds by and being insufficient and misleading. The other Arabic letters ح, ص, ص, ط, مل are omitted as unnessary having no distinct value in Balochí. م, and ق In the borrowed Arabic words phonetic correctness is all that is aimed at. Aspirates are represented by as or h following the aspirated consonant. The cerebrals are marked as in Urdú.

The Persian Alphabet as applied to Balochi.

Persian.	Roman.	Value.
1	a, i, u, á,	As in Persian, an initial introducing all vowels.
	e, ai, o, au	With the short vowel marks — — it forms
		a, i, u. With madda i it forms a. With following it forms i, e, ai. With following it forms u, o, au. As a medial and find it is always a.
ب	Ъ	As in English and Persian.
بهه	bb	Aspirated b.
پ	P	As in Persian and English.
پ ھھ ت	ph	Aspirated p .
ت	ŧ	Dental t as in Persian.
تهه	\mathbf{th}	Aspirated t.
تهه ث	th	As in Arabic, English th in breath, health.
<u>.</u>	ţ	Cerebral t pronounced as in Hindústání.
ٿهه	ţh	Aspirated t.
Z	j	J as in English.
ھھ جھھ	jh	Aspirated j.
E	ch	As in English church.

Persian.	Roman.	Value.
چهه	chh	Aspirated ch.
Ċ	kh	An aspirate guttural as in Persian, pronounced without harshness as in Pashto.
٥	d	Dental d as in Persian.
33	dЬ	Aspirated d .
2	ģ	Cerebral d as in Hindústání.
12	фh	Aspirated d .
કે	dh	As in Arabic, or English th in brother, breathe.
J	r	A clearly trilled r, as in Persian.
J	ţ	Cerebral r as in Hindústání, and like it nearly connected in sound with 5 d.
ز	z	As English z.
ز ئن س ژ	zh	As in Persian, or s in English measure.
ب	8	As in Persian. English s.
بتن	sh	As in Persian, the palatal sibilant. English sh.
	<i>gh</i>	As in Persian. A slightly pronounced guttural, not so harsh as in Arabic or Pashto.
ن	f `	A pure labial f , not partly dental as English f .
ک	k	As English & without any palatalization as in Persian.
گ	g	G hard as in English and Persian without palatalization.
ſ	m	As English m.
U	n	As English n. Also as a slightly pronounced guttural nasal, as in the final n of Persian or Hindústání plurals.
,	w , v	Either as English w or as a purely labial v , not as English v .
3	h	As English h. Occasionally mute as a final. When so mute it is not represented in transliterations.
G	y	As English y. Sometimes pronouncd with a slight tendency to become zh.

BALOCHI SOUNDS.*

1.—CONSONANTS.

لا k corresponds with Persian k, which however more usually appears in Balochi as کنه kh or خ kh.

kh as an initial represents Persian که k or خ kh; e. g.,

Balochi khush-agh Persian kush-tan

B. khar P. khar

B. khan-agh P. kun

As a final it sometimes represents $\mathcal{L}g$; e. g.,

B. gwánkh P. báng B. gurkh P. gurg

th seldom occurs initially, its place being taken by kh. As a final it corresponds with Persian k or g; e. g.,

B. hákh
B. rekh
P. khák
P. reg

g corresponds either with Persian g or b. As an initial gw answers to b (original v); e. g.,

 B. gandím
 P. gandum

 B. gíst
 P. bíst

 B. gwáth
 P. bád

 B. gwaf-agh
 P. báftan

 B. geth
 P. bed

gh does not seem to occur in true Balochi words, but to be confined to words of Indian origin.

 $\dot{g}h$ hardly ever appears as an initial. As a medial it corresponds with Persian g and h; as a final usually with h (whether pronounced or mute in modern Persian, also occasionally with g; e. g.,

B. jaghar P. jigar
B. nigháh P. nigáh
B. dighár P. díhár
B. jígh P. zih
B. roshagh P. rozah
B. ragh P. rag

In the words saghar 'head,' P. sar, and naghan 'bread,' P. nán, the gh has no consonant corresponding to it in the Persian.

[•] These explanations follow the order of sounds in the Table, p. 3.

The gk appears to be inherent in past participles, answering to the final h of the Persian, but it is not heard except in compound forms when followed by a vowel. Thus khutha, p. p. of khanagh means 'done,' but khutha-gh-ant 'they have done.'

ws frequently occurs as a final, in the place of n or nt; e. g.,

khanaghen — khanaghant.

Occasionally owing to a nasal style of pronunciation, sw stands for m, and s is interpolated as a final; e.g.,

nyánwán - nyámá

z ch generally corresponds with the same letter in Persian.

chh also represents Persian ch; e.g.,

B. chháth

P. cháh

B. chham

P. chashm

z i corresponds either with original Persian j or z; e.g.,

B. jihán

P. jahán P. zan

B. jan

P. zih

B. jígh

.....

jh is only found in words of Indian origin.

The cerebral consonants are found almost entirely in words of Indian origin. Before a dental, r is occasionally pronounced r, as mard for mard, gartha for gartha; but this is not universal and has not been marked in the Vocabulary. Leech represents this by d, but I have never heard it so pronounced.

હ t represents an original t, which however more usually becomes with.

th as an initial commonly represents an original t. As a final, and after a consonant medially, it often corresponds with Persian d; e.g.,

B. thákhtha
P. tákhta
B. thafar
P. tabar
B. árth
P. árad
B. khanth
P. kunad
P. burtha
P. burda

\$\delta\$ th (pronounced as in Arabic, like English th in nothing, heath), does not occur initially. As a medial and final it corresponds with Persian d. As a final it does not occur, unless preceded by a vowel; e. g.,

B. bráth P. birádar
B. gwáth P. bád
B. roth P. rúda
B. roth P. ravad
B. sith P. súd
B. rasitha P. rasúda

s d corresponds with Persian d as an initial and occasionally after a consonant; e.g.,

B. dem

P. adîm

B. khandaqh

P. khand-údan

33 dh only occurs in words of Indian origin.

initially. As a final and medial it corresponds with Persian d; e. g.,

B. dídhar

P. dídár

B. sadh

P. sad

B. rodh

P. rod

In some verbs dh as a characteristic represents a consonant which is

B. rudh-agh, p.p. rustha

P. rustan, Imp. rú

B. nyádh-agh

lost in modern Persian; e. g.,

P. nihádan, nih.

B. shodh-agh

P. shustan, shú, p.p. shustha

In madhakh 'locust' dh corresponds with l in Persian malakh.

In kághadh كاغذ the Persian spelling is preserved, though is pronounced dh not z.

In nadhra it represaents Arabic في in فطر.

on corresponds with Persian n.

rep corresponds with Persian p, also with f before a consonant; e. g.,

B. hapt

P. haft

B. gwaptha

P. báfta

ph as an initial represents Persian p and f; e.g.,

B. phanch B. phusht

P. panj

B. phur

P. pusht P. pur

B. phráh

P. farákh

if seldom occurs initially, its place being taken by ph. As a medial and final it commonly represents Persian b; e. g.,

B. thafar

P. tabar

B. shaf

P. shab

B. áf

P. áb

• b corresponds with Persian b as an initial and when not preceded by a vowel.

bh is found only in words of Indian origin.

w, v, has two sounds. The most usual is that of English w, which it receives [generally when followed by a vowel, and the other that of a

labial v (bh in Ellis's palæotype), which it receives when followed by a consonant or as a final, and in borrowed words of Sindhí origin. With both pronunciations it often corresponds with Persian b; e. g.,

B. zawán	P. zabán
B. warná	P. barná
B. savz	P. sabz
B. wháv	P. khwáb

Combined with h, w is pronounced like English wh in which; wh and w alone often correspond with Persian khw or kh followed by a labial vowel (u, ú, o). The guttural is either preserved in the aspirate h, or more frequently lost altogether (see h); e. g.,

B. whán	P. khwán
B. whár	P. khwár
B. wash	$\mathbf{P}.$ kh ush
B. wán-agh	P. khwán-dan
B. war-agh	P. khur-dan

m corresponds with Persian m.

sh as an initial corresponds with Persian sh. As a final and medial it corresponds either with sh or z; e. g.,

B. shaf	P. shab
B. ash	P. az
B. namásh	P. namáz
B. seshin	P. sozan
B. rosh	P. roz

Sher 'below' seems to correspond with Persian zer, but there is no other case of initial sh corresponding with z. Sher may be a contraction of ash-er 'from below.'

z corresponds either with Persian s or z; e.g.,

B. zuwár P. suwár

In the following words z corresponds with Persian d; viz.,

B. zí P. dí roz
A. zán-agh P. dán-istan
B. zámáth P. dámád

In zí 'yesterday,' mazain 'great,' zánagh 'know,' and zirde, a poetical word meaning 'heart,' the original Zend z is preserved. In zámath z represents an original j.

s corresponds with Persian s.

In zik and zarágh z corresponds with the j of Sindhi jik and jaru, but these words may have been borrowed by Sindhi. Cf. Pashto zik.

j zh corresponds with Persian sh, z and j; e. g.,

B. duzhman	P. dushman
B. azhmán	P. ásmán
B. drázh	P- daráz
R wéghé	P. khwáia

y, , r, and J l correspond with the same letters in Persian.

h generally represents an old Persian h, modern Persian h or kh; e.g.,

B. hushk	P. khushk
B. hon	P. khun
B. hí <i>kh</i>	P. khúk
B. phráh	P. fará <i>kh</i>

Borrowed Arabic words beginning with ¿ undergo a similar change, as:—

В.	hair	A.	<i>kh</i> air
В.	hatar	A.	<i>kh</i> atar

The above noted correspondences may be tabulated as follows:

Persian.		Balochi.
k	as an initial	kh
	medial) final }	kh
kh	initial	h, kh
	\mathbf{medial}	kh
	final	h, <i>k</i> A
g	initial	g
Ü	medial	gh
	final	gh, kh
ch	i niti al	chh
t	initial	th
ď	medial } final }	th, dh, th
р	i nitial	ph
P f	initial	ph
b	medial } final }	f, v, w
$\mathbf{s}\mathbf{h}$	\mathbf{medial}	zh (occasionally)
В	initial } medial }	z, zh (occasionally)
Z	initial	j

Persian.		Balochi.
Z	medial) final	sh, zh
h	medial } final }	gk
	initial	occasionally omitted

It will be noticed that the aspirates of the surd row (kh, chh, th) are very common, replacing the corresponding unaspirated Persian consonants, while those of the sonant row (gh, jh, dh, bh) seem to be entirely confined to words of Indian and Brahuí origin.

The letters kh, gh, th, dh, and f are usually medials or finals, representing the Persian letters, shown in the above table. Th and dh are never initials, and kh, gh and f, when they occur in borrowed words of modern introduction as initials, are usually pronounced f, g and f.

An initial h is occasionally lost altogether; e. g.,

B. asten

P. hastand

B. am

P. ham

II. VOWELS.

The vowel sounds in Balochi generally agree with those of Khurásání Persian. They may be arranged as follews:—

Long	á,	í,	ú	
Short	8,	i,	u	
Diphthongs	e,	ai,	0,	au

The most noticeable point of difference from Persian is the frequent substitution of the palatal series i, i, e for the labial series i, u, o; e.g.,

B. síth	P. súd
B. dír	P. dúr
B. seshin	P. sozan
B. gandím	P. gandum
B, bitha	P. búda
B. híkh	P. khúk
B. wasí	P. khusú
B. sírmugh	P. surma

A similar change sometimes affects borrowed Arabic words; e. g.,

B. málím

A. málúm

B. hír

A. húr

In a few cases the change is reversed; e. g.,

B. osht-agh

P. ist-ádan

B. súf

P. sev

Other variations from the Persian vowel system are rare.

THE NOUN.

I-TERMINATIONS.

- 1. Balochi nouns in their formation correspond closely with Persian. The original terminal vowels have been lost, and the majority of nouns now terminate in consonants. There is no distinction of gender.
 - 2. Vowel-endings.
- á. The majority of nouns ending in á are borrowed from Sindhí or Arabic. In the former case á sometimes represents Sindhí o, therein corresponding more nearly with Panjábí; e. g.,

Ar. hayá, duá.

Si. bhá, jherá, thorá, trámá, velá.

The words wázhá, zá, chawá, pásná and begá are not borrowed. Of these wázhá (P. khwájah) and begá in inflected forms drop the á, and take the termination ah as a base of inflection; e. g.,

wázhá, pl. wázhahán, lords

begá: abl. begahá, in the evening.

The borrowed noun velá time, is similarly treated. Other nouns ending in á take no inflections. Some Sindhi nouns as jherá, thorá have an alternative form in o which can be inflected.

í. This is a common termination being commonly used as in Persian to form abstracts as duzí, 'theft' from duz 'thief,' sakí strength from sak 'strong' &c., also as the termination of other abstract nouns not directly formed from Balochí bases as shádhí 'rejoicing,' ziyání 'injury.' It occurs also in other nouns as godí 'lady,' druhání 'pistel,' mavárkí 'assembly,' pahlí 'rib' (P. pahlú). A as a termination of borrowed words í is also found as in chárí 'spy,' mehí 'buffalo,' phallí 'section of a tribe.'

O is of frequent occurrence both in pure Balochí and in borrowed words; e. g.,

Balochi

mist díthlo, (P. dúd). sháthlo. Avob bathlo, . mortar nákho. uncle gokho, span mokho spider race, prize go watercourse io gwando alligator eagle duggo jaddo 6720 direction phalo

Borrowed	surgo leŗo	speech camel	
Dougwed	daddo,	non#	Si. dradro
	ψaάφο,	pony	
	paraddo,	echo	Si. parándo
	ghoro.	a band of horse	
	shaddo	a turban	
	lekho	reckoning.	

This o nearly corresponds in sound to the close English o, and never has the open Italian sound. Most words ending in o change it to av when followed by a vowel, whether this vowel commences a following word or an inflectional suffix. The o of the first eight words in the above list (dithio to jo inclusive) does not undergo this change. Go and jo are radical words, and the others end in the syllables lo and kho which probably had originally a distinct force of their own; e. g.,

	nákho jo	}	form the plural	{	ná <i>kh</i> oán joán
but	phale jaddo	}	are inflected	{	phalavá jaddavá.

Dihav 'leopard' may be classed with words ending in o, though I have never heard the termination pronounced otherwise than av. This v is a purely labial sound, not the English v.

U. ú as a termination does not seem to occur in pure Balochi words. It is found in a few words of Sindhi origin and undergoes no change in infections; e. g.,

ánú, an egg tilú, a bell varú, a beam límúa, lemon (Arable).

E has not been met with except in kahne 'pigeon,' also pronounced kahni.

Au is only found in jaw 'barley.'

3. Special terminations.

(a). Verbal Nouns,

Agh. This is the termination of the infinitive, and verbal noun which corresponds with it in form. It apparently corresponds with the Pashto verbal noun in ah, as final gh in Balochí generally corresponds with Persian h. Agh as a termination corresponds with the Persian termination ah in many other nouns; e.g., ramagh "a flock of goats," áhanjagh "a sash" &c. Some are verbal nouns in form as gwánzagh "a swing." The termination agh also forms collective nouns as murdánagh "the fingers," from murdán, Phádhagh "legs," from phádh.

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Okh. This termination forms the noun of agency from the Verbal base, and may be used with almost any verb; e.g., thursokh "a coward," from thursagh "to fear;" warokh "an eater," from waragh. These nouns of agency can be used and inflected as adjectives; e.g.,

mirokh, a fighter

mirokhen bing, fighting dog.

Okh is ocasionally found in other nouns besides those of agency as in gannokh 'fool.'

(b) Abstract Nouns.

í. This is the commonest termination for abstract nouns, which may be formed from other nouns, or adjectives; e. g., duzí "theft," sakmardi "valour," ghamí "grief."

Adh. Used in forming abstracts from adjectives of dimension; as,

gwandádh, shortness drázbádh, length phráhádh, breadth.

útá; as azmútá 'examination' from ázmainagh. ár; as dídár 'sight,' raftár 'paces.'

(c) Collective Nouns.

Agh. See above under verbal nouns.

gal. This is most usually employed to form collectives; e. g., jangal, a band of women from jan.

zahgal, a flock of kids from zah.

pahar, as gwar-pahar, a flock of lambs.

(d) Diminutives.

Ak, akh, ikh. This termination is frequently employed to form diminutives, sometimes modifying the base; e. g.,

janikh or jinkh girl, from jan woman

gwarakh lamb, from the base gwar—cf. guránd ram, and gwar-papar flock of lambs.

kisánakh very small, from kisáin.

This termination is occasionally used when all diminutive signification has been lost, as wasarikh, "father-in-law," (Persian khusar).

Ro, occasionally used, as in kisánro, a diminutive of kisáin 'small.' Possibly the termination lo in díthlo, sháthlo had originally the force of a diminutive. Compare also the adverbs khamro "a very little," from khan, and chíklo "a little."

4. Compound nouns and adjectives.

Compounds are numerous, and may be classed under the Sanskrit

divisions of Dwandwa, Tatpurusha, Karmadharaya and Bahuvrihi, or Copulative, Qualifying, Descriptive and Possessive.

c. Copulative. This class consists of nouns inseparably coupled together, only the latter being subject to inflection; e. g.,

phol-phurs, enquiry thaukh-tawár, conversation chukh-chorí, children.

- b. Qualifying or dependent. In this class the latter member of the compound is qualified by the former. The latter member may be either a nown or a verbal root, the verbal noun in okh being occasionally but not often used; e. g.,
 - (1). When both members are nouns. jogin-dár, a pestal (lit. mortar-stick). mazár-dumb, a plant (lit. tiger-tail). rosh-ásán, sunrise. chagá-hálwar, a matter of jest. chham-phusht, eyelid. máh-ghumá, eclipse of the moon.
 - (2.) When the first member is a noun and the latter a verbal root.

 shirwar, milk-drinking

 rozh-gir, eclipse of the sun (sun-seizing).

 godhan-din, udder-tearing (name of a plant).

 shav-khash, night-expeller (the planet Venus).

 mar-khushokh, man-slayer.

 sangband, connected by marriage.
- c. Descriptive. In this class the first member is an adjectives, numeral or other word simply describing or defining the second; e. g.,

syah-af, perennial stream, (lit. blackwater).

drázhdár, a beam (longwood).

mádhgor, female wild ass.

ergwáth, the leeside (lit. downwind).

chyár-gist, fourscore.

d. Possessive. These are formed in a similar manner to the last class, with the force of adjectives or descriptive epithets, the possession of the qualities described being implied; e. g.,

hor-dast, empty-handed.
phásh-phádh, barefoot.
sweth-rísh, greybeard
syáh-gwar, black-breast (e. g. the black partridge).
phodhán-demí, the name of a flower (lit. thither-faced).
dír-zánagh, far-knowing.
dast-basthagh, hands joined.

5. Inflection of nouns.

The suffixes used in forming the different cases are á, ár, egh, án, án á and ání, but these suffixes are put to a great variety of uses which will be considered under the different cases.

The most usual inflection is that in á. It may be used us an instrumental or nominative with verbs in a past tense, as an accusative, ablative, and locative, its place is to a certain extent taken in the plural by the suffix ání, the use of which is however more restricted.

- (1) The Nominative. The nominative of all intransitive verbs, and of transitive verbs in the present and future is the simple uninflected noun. With transitive verbs in tenses derived from the past participle the instrumental construction is employed, the inflected form in á being used for the agent while the object is left uninflected.
- (2) Genitive. In most cases the simple base is used with a genitive signification, but if greater precision is required the suffix egh is used, as

An mard bachh, that man's son; but have bachh ánhí mardegh en, he is the son of that man.

- (3) Dative. The termination ar or ar is employed for the dative, as: Mardumar naghana datha-i, he gave the man bread.
- (4) Accusative. The most usual ending of the accusative is á, but ár is frequently used, especially when emphasis is required or to distinguish a nearer object from a more remote; e. g., má Balochiyá rotí-ár naghan khanun. In Balochí we call "rotí" naghan.

The uninflected noun is also sometimes used for the accusative.

(5) Ablative, Locative. The inflected form in á is used with the prepositions go "with," azh "from," pha "on," man "in," gwar "in possession of," dan "into," and avr "in, upon," which alone precede the noun. It also expresses without a preposition position, motion to or from, time when. The meaning from is often implied without the use of the preposition azh; e. g.,

An ki kháí chí kádhiráWhatever thing comes from GodBahr-khanání go hádhiráThat I will divide with my heart.

Har shákhá házár shákh bítha On every branch a thousand branches sprang.

Har shákhá wathí gul bítha. On every branch its own flower.

Plural.

(6). An. The termination an is used for the nominative and accusative plural, but the singular forms are perhaps more frequently used. With numerals the singular is almost exclusively used.

ánrá. The plural dative in ánrá is also of rare occurrence, the singular being more frequently used.

ání. This is the most usual plural suffix, being always used for the genitive and ablative; e. g.,

pakhtání khund, the vale of poplars.

(7). The suffix e.

e is used in the sense of an indefinite article; e. g., mard 'man';

The indefinite base formed by the suffix e is used as a base of inflection, the case endings following the e. Thus from mardo we get mardeá and and and ardeár.

ADJECTIVES.

- 1. Adjectives are formed by the terminations i, en, ena, agh, o, and egh from nouns and adverbs; e. g.,
 - dem demí, former from phadhí, hinder phadhá mard marden, manly en, ena. nughraen, } of silver nughra nughraena, 5 gand gandaqh, bad aqh. gwátho, windy gwáth daregh, wooden dár eqh.
- 2. Adjectives precede nouns and generally take the termination en when used with nouns, unless the original termination happens to be en; as,

nughraen áden, a silver mirror

but

gwáthoen halwar, windy talk.

The adjectives jowain, good, kisain, small, and mazain, great, form respectively before nouns jowanen, kisanen, and mazanen.

3. Comparison. The comparative degree is formed by the suffix thar, thir, or tar; e. g.,

kisain comp. kisánthar and kasthar
burz ,, burzáthir
mazain ,, masthar
jowain ,, jowánthar
sak ,, sakthar,

the base being sometimes slightly modified. The word bathir (Pers. bihtar) is sometimes used with other adjectives to express comparison; as,

bathir gandagh, worse.

The word geshtar "more" corresponds to the Pers. beshtar, but the Positive is wanting in Balochi.

"Than" in comparison is expressed by azh, whether the adjective is put in the comparative degree or not; e. g.,

Azh tho nekh en, he is better than thou.

There is no special superlative form. The comparative form may be used, or the adverbs sakíá "extremely", hudháí "divinely" may be employed to give emphasis to the adjective. The phrase azh thewaghen or azh kullás "of all", may also be used with the comparative to give a superlative sense; e.g.,

Azh thewaghen masthar, the greatest of all.

NUMERALS.

1. CARDINAL NUMBERS.

Yak }	One
Ya) Do	Two
Sai	Three
Chyár	Four
Phanch	Five
Shash	Six
Hapt	Seven
Hasht } Hazhd }	Eight
\mathbf{Nuh}	Nine
Dah	Ten
Yázhdah)	Eleven
Yázdah	Fleagu
Dwázhdah Dwázdah	m . I .
Dwázdah 🚶	Twelve
Senzdah	Thirteen
Chyárdah	Fourteen
Phánzdah	Fifteen
Shánzdah	Sixteen
Havdah	Seventeen
Hazhdah	Eighteen
Nozd	Nineteen
Gíst	\mathbf{Twenty}
Gíst-u-yak	Twenty-one
Gíst-u-do	Twenty-two, and so on regularly
Sí	Thirt y
Chhil	Forty

Phanjáh Fifty
Sai-gíst Sixty
Saigíst-u-dah Seventy
Chyár-gíst Eighty
Chyárgíst-u-dah Ninety
Sadh A hundred

Shazh-gist A hundred and twenty
Hapt-gist A hundred and forty
Hasht-gist A hundred and sixty
Nuh-gist A hundred and eighty

Dosadh Two hundred Hazár

Hadhár A thousand

Lak One hundred thousand
Khor An indefinitely large number.

The form ya "one" is used with nouns; ya is used by itself.

Counting from sixty upwards is usually done in multiples of twenty, intermediate numbers being reckoned on or back from the nearest multiple; e. g.,

217 is sai kham yázhdah-gíst, i. e., three less eleven-twenties. 223 is yázhdah-gíst-o-sai, i. e., eleven-twenties and three.

2. ORDINAL NUMBERS.

Pheshí First Duhmí Second Saimí Third Chyárumí Fourth Phanchumf Fifth Shashumí Sixth Haptumí Seventh Hashtumí Eighth Nuhmí Ninth Dahmí Tenth Yázdamí Eleventh Dwázdamí Twelfth Senzdamí Thirteenth Chvárdamí Fourteenth Phánzdamí Fifteenth Shánzdamí Sixteenth Havdamí Seventeenth Hazhdamí Eighteenth

Nozdamí Nineteenth
Gístumí Twentieth
Síumí Thirtieth
Chhilumí Fortieth
Sadhumí Hundredth
Hazárumí Thousandth

Compound numbers are treated as single words in forming the ordinal; as,

Gist-yakumi Twenty-first Gist-phanchumi Twenty-fifth

3. FRACTIONAL NUMBERS.

one-half $(\frac{1}{3})$ nem
one-third $(\frac{1}{3})$ saiak
one-quarter $(\frac{1}{4})$ páo, chyárak
one-fifth $(\frac{1}{3})$ phanjak
three-quarters $(\frac{3}{4})$ sai-páo
one and a half $(1\frac{1}{3})$ yak nem or dedh
with one half more

g. four and a half (4½) sághoán chyár

With minuter fractions the word bahr is employed with the ordinal number, as Gistumi bahr, one-twentieth.

4. MULTIPLES.

a. Multiples of quantity, expressed in English by the word "fold."

dúrá double
yake sai threefold
yake chyár fourfold
yake phanch fivefold

and so on as required.

5. Multiples of time expressed generally by the word bar corresponding to the similar use of "times" in English. Bar is put in the plural except in ya-bare "once", where it receives the indefinite suffixes. Thi-bare "another time" is similarly constructed:

ya-bare once
do-barán twice
sai-barán thrice
chyár-barán four times

and so on.

PRONOUNS.

I .- PERSONAL PRONOUNS.

a. First person.

	Singular.		
Nom.	man, mah	1	
Gen.	maní, main	m y	
	maí <i>gh</i>	mine	
Dat. Acc.	manás	me, to me	
Instr.	man	I, from me	
Abl.	azh man, go man	with me &c.	
Plural.			
Nom.	má	we	
Gen.	maí n	our	
	$oldsymbol{ ext{mai}} oldsymbol{g} oldsymbol{h}$	ours	
Dat. Acc.	már, márá	us, to us	
Instr. }	má	we, us, &c.	

The plural má is often used with a singular signification.

thau, tha

b. Second person.

Nom.

Singular.

thou

thai	thy
thaí <i>gh</i>	thine
thará	thee, to thee
thau, tha	thou, &c.
Plural.	
shawá, shá	you
shawáí, sháí	your
shawái <i>gh</i>	yours
shawár, shár	you
shawá, shá	you
&c.	-
	thaigh thará thau, tha Plural. shawá, shá shawáí, sháí shawáígh shawár, shár shawá, shá

The singular and plural in the second personal pronoun are generally confined to their proper significations.

II .- THIRD PERSONAL PRONOUN AND DEMONSTRATIVE PRONOUNS.

The demonstrative pronouns "this" and "that" take the place of the 3rd personal pronoun, which only exists independently in the form of the pronominal suffixes to be noticed hereafter.

1. Proximate demonstrative pronoun.

Singular.

Nom.	esh, e, í	this, he
Gen.	eshí, eshiyá	of this, his
Dat.	eshiyar	to this, to him
Acc.	eshiyá, eshiyar	this, him
Instr.	eshiyá	he
Abl.	'sh eshiyá, go eshiyá, &c.	from this, from him &c.
	Plural.	
Nom.	esh, eshán	these, they
Gen.	eshání	of these, their
Dat.	eshánrá	to these, to them
Acc.	eshán, eshánrá	these, them
Instr.	eshání	these, they
Abl.	'sh eshání &c.	from them &c.

An intensive form is used with the prefix ham, sometimes corrupted to haw, as hawe, hamesh, hameshiyá, hameshání &c., "this very one, by this one."

2. Remote demonstrative pronoun.

Singular.

Nom.	án	that, he
Gen.	ánhí, ánhiyá	of that, his
Dat.	ánhiyar	to him, that
Acc.	ánhiyar, ánhiyá	that, him
Instr.	ánhiyá	that, he
Abl.	'sh ánhiyá &c.	from him &c.

Plural.

Nom.	ánhán, án	those, they
Gen.	ánhání	of those, their.
Dat.	ánhánrá	to those, them
Acc.	ánhán, ánhánrá	those, them
Instr.	án hání	those, they
Abl.	'sh ánhání &c.	from them &c.

This pronoun has also an intensive form with the prefix ham or haw, meaning "that one", "that very one", as hawán, hawánhiyá &c.

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The compound forms imar and anmar (for i-mard and an-mard) are frequently used in the sense of personal pronouns and are applied even to animals and inanimate objects.

3. Pronominal suffixes.

These are frequently employed with the verb when the regular pronouns are not expressed. Those of the 3rd person, i "he" and ish "they" are most frequently employed, the distinction between the singular and plural forms not being carefully observed. (For examples, see under the verb.) The suffix is also sometimes used in the 3rd person as khuthaghantin "they did." The 1st person has also a suffix in, which is not so frequently used. With this suffix the verb takes a peculiar form, a euphonic t being inserted to strengthen the weak final nasal of the 1st person singular or plural, as khushthaghantin or khushthaghantin "I or we killed."

III .- RELATIVE PRONOUNS.

The word ki performs most of the duties of a relative pronoun, as in Persian, and often merely has the meaning of a relative particle, being indeclinable, so that the meaning is not complete without the use of other pronouns; e. g.,

E mard hameshen ki eshiyá biráthá má gipthaghún, this is the man whose brother we have taken.

The following relative phrases are used:

har khas ki whoever
har ki har chí ki whatever

śa ki who, whoever, whatever

e. g.,

har khas ki khákht, every one who comes har ki thau gushe, whatever you say an ki khái' chí kádhirá, whatsoever thing comes from God.

IV.—REFLECTIVES.

Wath, self.

	Singular.	
Nom.	wath	\mathbf{self}
Gen.	wa <i>th</i> í	own, one's own
Dat. }	wa <i>th</i> ár	self
	Plural.	
Nom.	wathán	selves
Gen.	wa <i>th</i> ání	own
Dat. }	wa <i>th</i> ánr á	selves

The words jind and but are also used in the sense of "self." oneself, wathi wath or wathi jind

e. g.,

Knmar wathi jindár khushtha, he killed himself.

Jind is especially used in referring to one's own private property, as the Hindústání nij; e. g.,

hawe mádhin maní jindeghen, this mare is my own property.

The phrase pha-wathán is used for among themselves, ourselves, yourselves.

V.-INTERBOGATIVES.

Who, kháí?

Sing. and Plur.

Nom.	k háí	who?
Gen.	khái <i>gh</i>	whose?
Dat. Acc.	kháiár	whom?
what?		chih
which,	what (qualifying	a noun) kithán thán
how mu		chikhtar, chikar
how ma	my? }	(P. chi qadr?)

VI.—CORRELATIVES.

so much	ik <i>h</i> tar, ikar
so many	(P. ín qadr ?)
just so much	hawikhtar (P. hamin qadr?)
that much	ánkhtar
just that much	hawánkhtar

VII.—INDEFINITE.

khase	any one, some one
har-khas	. every one
khas nen	nobody
hech	·
hechí	any
'chí	•
har chí	everything
'chie	something
'chie-'chie	a little
hechí-na	11.
'chí-na	nothing

báz	many
kham	few
geshtar	more
kharde	some
yak-áptiyá	one another
thí phithí	other, another
thí khase	some one else
thí 'chie	something else
thí 'chí-na	nothing else
theghi thewaghen	all
drust kull las	the whole
kullán-phajyá	altogether
hardo	both

STRUCTURE OF THE VERB.

The simplest form or base of every verb is with one or two exceptions identical in form with the 2nd pers. sing. imperative. From this base are formed immediately, by the addition of certain terminations, the imperative, sorist, infinitive and present participle. The termination of the infinitive is syl. From the base so obtained two more tenses, the present and imperfect, are formed. The past participle is formed from the base in a manner which will be described hereafter, and other past participles are formed from it as a base.

(a). Forms derived immediately from the base.

The imperative, as observed above, generally is the simplest form of the base. Verbs beginning with vowels take the prefix ba or bi, and the verbs waragh "to eat" and ravagh "to go" also form their imperatives bawar and baro. Verbs beginning with vowels take also the prefix bi or kh in the aorist. These prefixes are not used either in the imperative or aorist when a negative is expressed, the negative particles na, ni and ma taking their place; e. g.,

riyár ·	bring	
mayár	do not bring	
bilán	I will let	
nelán	I will not let	
kháíth	he will come	
nayáí <i>th</i>	he will not come	

The prefix kh is most usually taken in the acrist, but the verb ilaght to let" always takes b.

The agrist has both indefinite, present, future and subjunctive significations. The terminations are as follows:—

Singular.		Plural.
1.	án	ún, om
2.	е	eth, edh, e
8.	th, th, ith, i	ant

The most usual termination of the 3rd person singular is ith, which often becomes simply i. The following take th:—

Infinitive	3rd pers. sing. aorist
khana gh , to do	khanth
janagh, to strike	janth or jath
gira <i>gh</i> , to take	gírth
baragh, to take away	bárth
waragh, to eat	wárth

In giragh, gir is the radical form of the verb. In baragh and waragh the radical vowel is lengthened. The following take th;—

biagh to be	bí <i>th</i> , bí
ravagh to go	roth, ro
deagh to give	$\mathrm{d} ath, \mathrm{d} a$
siagh to swell	${f sith}$

The present participle used of a continued or repeated action is formed from the base by the termination ana; e. g.,

Infinitive Present Participle.
bíagh bíána
khanagh khanána

The infinitive in agh is a noun and can be inflected. The inflected form has a gerundial signification; e. g.,

khanagh, to do, doing.

-khanaghá khapta-í, he began to do (lit. he fell a-doing).

The present and imperfect are formed from the infinitive by the following terminations:

PRESENT.

		TERRITA T.
	Sing.	Plur.
1.	án	áún, áom
2.	е	e, eth
3.	e n	ant, an, en
	I	PERFECT.
1.	athán	$oldsymbol{a} t h \acute{oldsymbol{u}} oldsymbol{n}$
2.	athe	a <i>th</i> e
8.	ath, eth	a <i>th</i> ant

The past participle is formed by the addition of the suffix that or the base which is liable to modifications to be noted below. For purposes of composition the past base ends in gh. (See sounds, gh.) From the base so formed the perfect and pluperfect are formed by the following terminations:

PERFECT.

1.	án	•	ún, om
2.	е		e, eth
3.	_		ant
		PLUPERFECT.	
1.	a <i>th</i> án		a <i>th</i> ún
2.	athe		athe
Q	ath á		athant

The 3rd pers. singular of the perfect is the simple form of the past participle without the gh. In transitive verbs with an object and agent, this form expresses the perfect throughout, the agent being in the inflected or instrumental form, while the object is uninflected; e. g.,

mardumá naghan wártha, the man ate bread,
where mardumá is the inflected form of mardum. But—

mardum naghanár wárth, the man will eat bread.

Here mardum is uninflected and naghan receives the objective inflection.

The terminations of the present are nearly identical with those of the perfect, and those of the imperfect, with the pluperfect. Both seem to be formed by the addition of the present and past forms of the defective verb to be to the infinitive base and the past base respectively. The present with the infinitive base forms the present, with the past base the perfect. Similarly the past forms the imperfect and pluperfect. These forms are as follows:

PRESENT.

Sing.		Plur.	
I am	án	we are	ún
thou art	е	you are	e
he is	en.	they are	ant
	P.	AST.	
I was	athán	we were	a <i>th</i> ún
thou wast	athe	you were	athe
he was	a <i>th</i>	they were	a <i>th</i> ant

The plural forms ún, e, athún, athe, when used with a pronoun immediately preceding, take the prefix kh; e. g.,

má khún we are má khathún we were

But this prefix is never used when a noun or adjective immediately precedes.

From the simple past participle which has both an active and passive signification are formed two other participles; viz., (1) the active past participle, used of a completed action and only found before a verb in a past tense. This is formed by changing the termination tha, tha into tho. (2) The present participle used of a continued but not repeated action. This is formed by changing tha or tha in thiyá, thiyá or sometimes thighá, thighá.

The use of the four participles may be shown as follows:

FORMATION OF THE PAST PARTICIPLE.

The termination is either tha or tha which is added to the base. That is the more usual. It is taken by all verbs whose bases end in a vowel. Verbs ending in mutes take that as a rule, with a short vowel inserted after the characteristic; e. g., bashkagh "to give," P. P. bashkatha. When a verb corresponds with a Persian verb in idan, a short i is sometimes inserted; e. g.,

rasagh, to arrive P. P. rasitha (P. rasidan). thursagh, to fear P. P. thursitha (P. tursidan).

When that is used it is always attached to the base without an intervening vowel. This leads frequently to the modification of the characteristic of the base, the changes corresponding closely with those which take place in Persian. In some verbs the vowel of the base is also changed, and others are wholly irregular. Verbs whose characteristic is n (a class which includes all causals) take the termination that without any modification of the base.

The most usual changes of characteristic letters are sh and zh to kl, to p, dh and z to s. Many verbs in sh and s, take the termination without modifying the characteristic.

The following list gives the past participles of all the irregular verbs, also most of those which form their past participle by taking the without modification of the base. The verbs beginning with vowels which take the prefixes b, bi and kh in the imperative and agrist are also given.

Infinitive		Past Participle	
áragh	to bring	ártha [*]	
ása <i>gh</i>	to rise	ástha	
ashkhana <i>gh</i>	to hear	ashkhu <i>th</i> a	
ágh	to come	ákhtha, átka	

Infinitive.	Past Participle.		
aksa <i>gh</i>	to sleep	akastha	
ila <i>gh</i>	to let	ishtha	
oshta <i>gh</i>	to stand	oshtá <i>th</i> a	
oshtalainagh (caus	al of oshtagh)	oshtalaintha.	
(The above to	ake the prefixes b, bi, an	d kh.)	
bása <i>gh</i>	to low	bástha	
bágh	to be killed	bái <i>th</i> a	
bara <i>gh</i>	to take away	burth a	
bresa <i>gh</i>	to spin	brestha	
bush <i>kagh</i>	to discharge (a gun)	bu <i>kh</i> th a	
bozha <i>gh</i>	to open	bo <i>kh</i> tha	
banda <i>gh</i>	to shut, tie	bastha	
bía <i>gh</i>	to be	bí <i>th</i> a	
phadea <i>gh</i>	to run	phadá <i>th</i> a	
phrusha <i>gh</i>	to burst	phrushtha	
phasha <i>gh</i>	to cook	phakká	
thusa gh	to faint	thustha	
thosa <i>gk</i>	to extinguish	thostha	
thash a gh	to run, gallop	tha <i>kh</i> tha	
thásha <i>gh</i>	to gallop (a horse)	thá <i>kh</i> tha	
já <i>gh</i>	to chew	jái <i>th</i> a	
jana <i>gh</i>	to strike	ja <i>th</i> a	
china <i>gh</i>	to pick up	chitha	
dina <i>gh</i>	to tear	dirtha	
dosha <i>gh</i>	to milk	dushtha	
dosha <i>gh</i>	to sew	do <i>kh</i> tha	
dogh_	to fetch water	dotha	
deagh'	to give	dátha	
rava <i>gh</i>	to go	shutha, shudha, raptha	
ru <i>dhagh</i>	to grow	rustha	
radhagh	to tear up	rastha	
runa <i>gh</i>	to reap	rutha, runtha	
resina <i>gh</i>	to pursue	resintha	
rísha <i>g h</i>	to scatter, pour	ri <i>kh</i> tha	
zágh	to bring forth	zátha	
zána <i>gh</i>	to know	zántha	
zina <i>gh</i>	to snatch	zítha, zi <i>tha</i>	
zíra <i>gh</i>	to raise	zurtha	
susha <i>gh</i>	to burn, be burnt	su <i>kh</i> tha	
sosha <i>gk</i>	to burn (tr.)	sokhtha	
sinda <i>gh</i>	to break	sistha	

Infinitive.		Past Participle.
sía <i>g h</i>	to swell	sí <i>th</i> a
shu <i>dhagh</i>	to hunger	shusth a
shodhagh	to wash	shusth a
shasta <i>gh</i>	to send	shastá <i>th</i> a
shamúsha <i>gh</i>	to forget	shamushtha
shawashka <i>qh</i>	to sell	shawa <i>kh</i> tha
khashagh	to pull, turn out	khashtha
khisha <i>gh</i>	to cultivate	khishth a
khushagh	to kill	khushtha
khafa <i>gh</i>	to fall	khaptha
khanagh	to do	khu <i>th</i> a
kiza <i>gh</i>	to allow	kishtha
gágh	to copulate	gátha
grádhagh	to boil	grástha
garda <i>gh</i>	to return	gartha
giragh	to take	giptha
giregh	to weep	girenth a
guzagh	to pass	gwastha
gusha <i>gh</i>	to speak	gwashth a
galágh	to praise	galáitha
gindagh	to see	ditha
gwáfagh	to summon	gwáptha
gwaragh	to rain	gwartha.
gwafagh	to weave	gwaptha
gezha <i>gh</i>	to bear abortion	gi <i>kh</i> tha
gieshagh	to pay, pick out	gíeshtha
láinagh	to touch	lai <i>th</i> a
laghushagh	to slip	la <i>gh</i> ush th a
lawásha <i>gh</i>	to drink	lawáshtha
madhagh	to freeze	\mathbf{mastha}
mira <i>gh</i>	to die	murtha
miragh	to fight	mi <i>ratha</i>
mizha <i>gh</i>)	
meza <i>g</i> h	to urine	mishtha
misha <i>gh</i>	to suck	mishtha
musha <i>gh</i>	to rub	mushtha
nigosha <i>gh</i>	to listen	nigoshtha
ninda <i>gh</i>	to sit	nishtha
nyádhagh	to post	nyástha
wána <i>gh</i>	to read	wántha
wapsagh	to sleep	waptha
- 4	• .	•

Infinitive.

waragh hushagh to eat to dry Past Participle.

wártha hushtha

Causals. The causal is commonly formed by adding the suffix ain to the root; e. g.,

tharagh, to return.

tharainagh, to cause to return, i. e., to give back.

Oshtagh "to stand," and nindagh "to sit," form their causals thus:—oshtagh—oshtalainagh.

nindagh—nishtainagh (to lay, spread out.)

Some of the verbs given in the above list are causals, the intransitive verb becoming transitive by a change in the radical vowel resembling the Sanskrit guna or vriddhi, see—

sushagh, soshagh; thas hagh, thát hagh; thus hagh, thos hagh.

Compound Verbs. Verbs are compounded with prepositions, with nouns and with other verbs. The most common of those compounded with prepositions will be found under the words اير er "down," سفه mán "in;" dar "out;" and ولا gon "with" in the vocabulary. In verbs which take the prefixes bi, b, and kh these are inserted after the prepositions, as are also the negative particles na and ma; e. g.,

phajyá together. Aragh to bring. phajyá áragh, to recognize. phajyá kháríth, he will recognize. phajyá nayártha, he did not recognize.

Compound phrases of a noun and a verb are common. The verb, khanagh "to do," deagh "to give," janagh "to strike," and giragh "to take" are most commonly used in this way; e. g.,

sar giragh, to set out dem deagh, to send

One verb frequently qualifies another, the two verbs being used in the same tense and person throughout. The active past participle is never used unless followed by another past tense; e. g.,

ilagh deagh, to let go
bilán deán, I will let go
ishtho dátha, he let go
tharagh ágh, to come back
tharán khán, I will come back
thartho ákhthaghathán, I had come back

The particles i and ish. These particles are appended to verbs and take the place of the pronouns of the 3rd person when not expressed before the verb. The singular form is i and the plural ish, but in practice they are used almost indiscriminately. They express (1) the agent of the verb in the 3rd person; (2) the object of an action, or the instrument by which it was performed; e. g.,

(1) khutha, did or done

án khutha or he did khutha-i,

ravaghathant-i, they were going

jatha-ish, they struck

hechi nestath-i, there was none of it (lit. anything it was not).

(2) wath gindíth-í, he will see himself man kharán-í, I will bring it harkhas phajyá-kháríth-í, every one recognizes him.

Verbal Noun. From most verbs a verbal noun of agency can be formed by the suffix okh being added to the base; e. g.,

giragh, to take; girokh, taker, creditor khushagh, to kill; khushokh, murderer.

ADVERBS.

A great part of the Balochi adverbs are more properly adverbial phrases, only a few being original adverbs. Many are nouns in oblique cases, others phrases of several words.

(1.)—Adverss of Time.

now ní, nín hadhen, án-vakhtá then when ? khadhen to-dav maroshí, mar'shí yesterday zí the day before yesterday phairí three days ago phisphairí last night doshí night before last pharandoshí to-morrow bánghá, bánghavá the day after to-morrow thí bánghá, phithí-roshe in the evening begahá

to-morrow evening now-a-days formerly first, before afterwards hitherto henceforward vet, till now, hitherto always, perpetually now and then at one time and another once at once again then, again another time at last early

bánghá-begahá, nawáshí-begahá
nínavakhtá, maroshí-nawáshí
olá
pheshá
phadhá
shedh-pheshá
shedh-phadhá, shedh-demá
dáín, dání, dánkoh, daníkará
harro
damdame, dame dame
yabare
yabará
agh, aghdí, aghathán
gudá

phagen rosh-tiká

nyámá

thíbare

áhirá

(2).—Adverbs of Place.

a. Rest in a place.

here there before, in front of behind near far out outside above below down on, ahead where ? on this side beyond, on that side everywhere nowhere elsewhere anywhere in the middle

at daybreak

odh, odhá, hamodh, hamodhá demá phadhá, dímá, pha-dímá nazí, nazíkh dír dar darrá kharqhá, burzá jahlá, sher, buná er sará bakhú? inbará, shinbará ánbará, shánbará harhandá thíhandá hizhgarnen hizhgar.

edh, edhá, hamedh, hamedhá

b. Direction to or from.

hither thither

thither

hence
thence
whither?
whence?
in this direction
in that direction
from this direction
from that direction
in every direction
in what direction?
onwards, upwards

downwards

from above downwards inwards outwards phedh, phedhá, ingo, ingwar phodh, phodhá, ángo, ángwar,

phawángo

shedh, shedhá, shamedhá, shingo shodh, shodhá, shamodhá, shángo

thángo?
ashkho?
in-phalawá
an-phalawá
'shín phalawá
'shán-phalawá
thán-phalawá?

sará

erá, sherí -pahnádhá

sará-erá andará darrá

(3).—Adverss of Quantity.

much, many few, little, less a little very little more

enough a great deal, any amount

báz kham chíklo khamro geshtar gwas, bas khor

(4).—Adverbs of Manner, &c.

From most adjectives an adverb of quality or manner may be formed by the suffix iyá, the adjective being sometimes slightly modified; e. g.,

gandagh, bad jowain, good gandaghiyá, badly jowániyá, well

Other adverbs of manner are:

very together quickly sakíá, sakíghá phajíá zíthen

perhaps nawán, kaizán why? pharche mundo, be-shak altogether, certainly, doubtless hanchho, hachho thus how? chachho? chon? in this wav e-ranga, e-r'gá ánrangá, ár'gá in that way harrangá every way thánrangá in what way? hechi-na, 'china, mundo na never

PREPOSITIONS.

There are few prepositions, properly speaking, in Balochi, as most of the particles so used follow the noun and would be more correctly called postpositions.

The following are prepositions proper and precede the noun which is governed in the oblique form (ablative or locative).

go with, together with, in company with gwar with, near, in possession of pha on, for, among mas, más in, into das into, to, up to azh, ash, shi from, than avr on, into

From the above, some prepositional phrases are formed, of which the first member precedes, and the last follows the governed noun.

go—gon in company with
go—phajyá together
azh—siwá except
azh—darrá without
pha—randá on the track of
azh—phalawá away, from
azh—phadhá behind

The postpositions do not put the noun governed in an oblique tense in the singular. The force is often that of the genitive, which has no distinct form in the singular, but as might be expected the genitive plural is often used. Pronouns also take the genitive in the singular.

on	sará
on, upon	chakh á
towards	nem <i>gk</i> á, ne <i>gk</i> á, phalawá
on account of	sángá
along with	phajya
in	nyámá, nyáswás
out of	darrá
near	khund, gwará
before, in front of	demá
behind, after	ph adká
before (in time)	pheshá
over	sará, khar <i>gh</i> á
under	buná
beyond	'shánbará
on this side of	'shinbara
for, on account of	phar

Examples.

in the presence of

like

in, in the middle of

—	
khoh buná	under the hill
khohání sará	on the hills
go wa <i>th</i> í sardárá	with his own chief
drogh pha ímáná khátáen	falsehood is a blot upon honour
dast jant avr barziyá	she puts her hand into the bag
eshiyá pha <i>dh</i> á	after this
thai sángá	on your account
bozhí láfá	in the boat

rúbarú

daulá, wájh

láfá

CONJUNCTIONS.

also, too both, and and, then	dí dí, dí guạ á
and (copulative between	٠.
nouns)	0

when vakhtá-ki

whenever án-vakhtá-ki, har-vakhtá-ki,

har-velá-ki

wherever har-handá-ki, handá-ki

until

as, like as

whithersoever har-phalawá-ki if ki that ki but lekin (rare) or ki, hai either, or hai, hai neither, nor na, na not na " (with imperatives) ma. else, otherwise na. lest cho-ma-ví-ki because, in order that hawe sangá-ki although agharchi (rare)

INTERJECTIONS.

dáin ki

chon-ki, chachhon-ki

yes hau!
yes, certainly bale!
no na, inná
see there gind
behold marvehí
yes, sir wázhá!

my lord wázhá maní, sáin!

welceme! biyá durr sh'ákhte, biyáthai

all's well mahairá
well done wáh

bismi'lláh in God's name

salám alaik, alaik salám greetings between Musalmáns

phrr fie! O halloa.

LIST OF ABBREVIATIONS.

A. Ar.	•••	Arabic.	Poet.	•••	Poetical.
Ρ.	•••	Persian.	Adj.	•••	Adjective.
Panj.	•••	Panjabí.	Adv.	•••	Adverb.
P.P.	•••	Past Participle.	Prep.	•••	Preposition.
S.	•••	Substantive.	Br.	•••	Brahoi.
Si.	•••	Sindhí	М.	•••	Masculine.
Skr.	•••	Sanskrit.	$\mathbf{F}.$	•••	Feminine.
v.	•••	Verb.	Cf.	•••	Compare.
			H.	•••	Hindí.

Note.—The Arabic letters ق ع ظ ط ف ص ح are not used in this vocabulary, having no distinct pronunciation. They are represented by and I when they occur in borrowed words.

VOCABULARY.

11

(Words beginning with vowels.)

أب Ab, P. (metaphorically) honour, dignity. Not used in the meaning water. (Ab er-kanagh) to disgrace.

ابا Abbá, A. Br. father, papa. (Used by children.)

اباً Ubbá, Si. north.

ابتر Abtar, hyæna, (P. kaftár.)

Abresham, P. silk. آبریشم

ابناخ Kbnákh, P. honourable, worthy.

ליאוֹן Ubhár, Si. raising. (Poet. in the phrase 'uchál-ubhár' lowering and raising.)

آپتیا Aptiya. Only in the phrase 'yak aptiya,' among themselves.

اپورس Apúrs, (P. ávran, árus) the Juniper tree. (Juniperus excelsa.)

Aphán, a leather bag for flour.

أبهرغ Kphiragh, p.p. áphirta, (Si. áphirjnu) to swell.

Ath, was. 3rd pers. singular of past indef. of the verb to be. The complete tense is athan, athan, athan, athan, athan.

اجال Uchál. S. See Ubhár.

Achá, (Si. achho) clean.

آجام Kjám, (P. anjám) settlement, arrangement.

Ajab, (A. عجب wonderful. Ajab-rang, beautiful, purple-coloured.

Akhirá, A. utterly, extremely.

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ادب Adab, A. good manners.
    ادت Adit, Si. Panj, Sunday.
       ادغ Adagk, v., to pitch a tent, encamp.
     ادین Aden, a mirror.
        31 Ad, Si. a masonry watercourse.
   اق ديئغ Ad-deagh, v., to lean.
        [3] Addá, Si. Br. brother (familiarly).
    آدَر غ Udragh, (Si udirņu,) to fly.
   اَدَوهي Udohí, Si. a white ant.
     اقى Addí, S. Br. sister (familiarly).
      Kram, P. rest.
     Arth (P. árad) flour.
      J. Turd. an army. (P. urdú.)
     ارزاك Arzán, adj. P. cheap.
    ارسى Krsí, adj. Si. idle.
     ارغ Kragh, p.p. ártha; imp. bi-ár; fut. khárán. (P. ávardan,
             bi-ár) to bring. Kárá áragh, to use. Phajyá áragh,
             to recognize. Gír-áragh, to remember.
    ارمان Arman, pity. P.
    だップ Krokh, bringer. Verbal noun from áragh.
     آريخ Arikh, gums.
ازاب دئيغ Azáb-deagh, A. Bi. to offend.
     ازاد Azád, free. P.
Izbokht, the ajwain seed.
    ازمان Azmán, ) the sky. (P. ásmán.)
  آزماينغ Azmáinagh, to examine. P.
   أزموتا Azmútá, examination.
      jl Azh, from. (P. az. Pázand ezh.)
      Azhgizh, flint and steel. (Cf. P. azkhash.)
   Azhmán. See Azmán.
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izhwark, ) ازورک
     ás, fire. (P. átish).
   ás-rokh, a platform erected where funeral ceremonies
             have been performed.
   ás-khoh, flint (lit. firestone).
      أسان ásán, easv.
     asp, horse. (The generic term.)
   uspust, lucerne grass.
   isphulk, the spleen. Br.
   استا astá, was.

Parts of the defective verb to be, to exist.

(P. hastan. Sk. As.)
     astár, star. (P. sitára.)
     istaragh, razor. .
      ástagh, slowly. (P. áhista.)
     istur, coarse, thick.
     ástín, sleeve. P.
     istín, a light cloud, cirrhus.
       asr (a. اگر ), impression.
       asur, dawn, morning twilight.
       ásur (a. صر ), mercy.
      isrár, mystery, secret. A.
     ásrokh, the third day of mourning. A platform erected
             to commemorate it.
       asagh, p.p. astha, fut. khasan, imp. bias, to rise. Asan,
             rising. Rosh-ásán, sunrise.
     ásk, a deer (f.) (P. áhú.)
ásk-mahisk, a kind of fly.
       asul (a. اسل ), original.
        asulá, from the first. Asulá gannokh, a born idiot.
      ásin, iron. (Cf. P. áhan.)
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ashá, a. eight o'clock in the evening.
    ash, from. (P. az)
 ash-koh, whence?
ash-modhá (for azh hamodhá), thence.
ashmedhá (for azh hamedhá), hence.
 ashtáfí, s. quickness. (P. shitábí.)
   ashkanagh, p.p. ashkutha, imp. bi ashkun, to hear,
                   Compounded of ash-knanagh. (Ash = Skr.
           listen.
           asru.)
  ishtha, p.p. of ilagh. q. v.
    oshtaqh. See وشتغ oshtaqh.
      agh, adv. conj. again, then.
     ágh, p.p. ákhtha, imp. biyá, fut. khán, (P. ámadan, biyá).
           to come.
                          phedh aghen, as coming.
                          er-ágh, to come down.
                          dar-ágh, come out.
                          mán-ágh, be applied, suit, hit.
                          Phádh-ágh, rise.
                          dast-agh, get, come to hand.
                          kárá-ágh, be of use.
  ágháhí, warning. (P. ágáh.)
   aghdí, again. Also اغدى agh. q. v.
     aqhar, if. (P. agar.)
   agharchi, although (rare),
    aghl (a. عقل), intellect.
     aghmá, effort, endeavour.
    áf, water. (P. áb, Z. áfs.)
ف أردخ af-aro kh, } water-bearer.
áf-bíagh, to melt, thaw.
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أف داري af dari, irrigation. غ أف ديكم af-deagh, to irrigate.

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af-shef, slope, watershed.
 af-laghar, rapid, waterfall. أف لغر
áf-murgh, waterfowl. آف محرغ
ف درك áf-drik, a kind of grass. (Panj. manihár.)
   أفسري áfsin, pregnant. (Cf. P. ábista.)
   أفشك áfshik. s. soup. (Cf. P. áb-zah.)
    afkin, box for holding collyrium.
    áfím, opium. (A. afyún.)
    iktar, } so much, thus much. (? P. In kadr.)
    akas, envy.
    aksagk, p.p. akastha, fut. kaksi, imp. biakas, to sleep.
    aksará, generally.
     akul (a, عقل), intellect, wits.
   غلامة أكباك ákhán, proverb, anecdote.
    ákhar, buttermilk.
   أكبيرو ákhero, nest. Sì.
     لكيا ukaiyá, in that way, of that sort.
     الياً akila (a. هليقد), celebrated.
   ag, rate of sale.
     رعائج iláj, cure. (A. عائد)
   aláhida, separate. (A. عميله)
   ألسم álsí, idle. Si.
      ilagh, p.p. ishtha, fut. kils. imp. bil. (P. hishtan, hil),
            to leave, abandon. ilagh-deagh, p.p. ishtho-dátha, to
           let go.
     ulkah, the world, the universe.
   amb, mango. P.
  ambází, embrace. (P. ham, bázú.)
    ambur, forceps. P.
   ambráh, servant, companion. (? P. hamráh.)
   ambal, mistress, lover; companion.
    ámdan, income. (P. ámdan, to come.)
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imar, he, this man, this. For in mard.
 umar, age. (Ar. عمر ).
  ámur, slowly.
amsaro, equal in age or otherwise.
 amul, mistress (see ambal).
amsodh, grief. (Cf. P. afsos).
annám, namesake. (P. hamnám.)
 amír, chief.
   an, dem. pro. that, he.
_i anhí.
              Genitive of án.
م anhiva آنبياً
anhiyar. Objective and dative of an.
 أنبر anbar, أنبر anbar, } beyond, on that side.
 inbará, on this side.
anjír, s. fig ; khohí anjír, wild fig. P. see hinjir.
 andará, adv. inside.
andemá, adv. thither, that side.
 indemá, adv. hither, this side.
insaf, s. justice. (A. انساني).)
 anzí, s. a tear. P.
 أنكآر ánktar, so much, as much as that. (f. P. ánqadr.) أنكار
  أنكارا ángárá, Tuesday. Si.
angane, innumerable.
  ángo, thither, in that direction.
   ingo, hither, in this direction.
 anmácha, an ammunition pouch. See hambácha.
   ánmar, he, that man, that. (For an mard.)
   ánú, egg. Si.
   unhálá, hot weather.
 anishaqh, s. (P. anusha), forehead; fate, fortune.
   áwár, spoil, plunder.
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أوار áwár, mixed. P. Awár bíagh, to mix with, join.
      áwáz, voice. P.
   obásí, yawn. ارباسي
      obhar, east. اوبهر
                       Si.
     otak. s. a halt ; otak khanagh, to halt, encamp.
     othar, s. a dust-storm.
     oţigh, s. } a tank. ورتيخ oţi, s.
   ojágho, awake. Si.
    ojrí, stomach. Si. Paj. See saghindán.
   ávdárí, s. irrigation.
       avr., on, upon, into. (Pázand, awar, on, over.)
      odhá, adv. there.
      auzár, tool.
     iwazi, revenge, substitute. (A. اورى)
      awarzá, pleasing, agreeable.
     oshtagh, v. p.p. oshtátha: imp. bosht, to stand, stay. (P.
             istádan.)
   oshtalainagh. Causal of oshtagh, to post, set up.
      ogál, chewing the cud. (Si. Ogár.)
       olá, adv. formerly. (From A. اولاً
     olak, beasts of burden. (? Turkish wulágh.)
      olah, west. Si.
      oli, adj. former.
      ondo, overturned. Si. Ondo khanagh, to upset,
auhsán-khatá, a puzzle.
     obí, ارهي obíl, على ohíl, ا
      aver, late. Si.
        šī áh, in, ah! alas!
      ahár, the hot weather, the month Asárḥ (Si. Panj. Ahar).
     ahsán, mankind. (A. ahsán.)
    أهنجغ áhanjagh, a sash, kamarband. P.
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e or í, prep, this.
  er'gá, ایرکا er'gá, ) in this way.
    اید edh, adv. here. (Cf. Zend. aétadha.)
    er, adv. down, below. $\frac{2}{2} \alpha \text{sh'er, from below. (Cf. P. zer, from below.)}
          below.)
  er-ágh, to come down.
 er-baragh, to swallow.
 er-janagh, to cast down, abase.
 er-shafagh, to go down, set (of the sun). p.p. er-shutha.
  er-ravagh, to go down.
er-shaf, s. going down.
                             Rosh-er-shaf, sunset.
 er-khafagh, v. to descend, alight.
 er-khanagh, v. to lay down, place.
er-gwath, the lee-side; er-gwatha, to lee-ward.
er-nindagh, v. to sit down.
  esh, this. (Cf. Zend. aesha.)
  imán, honour.
   in, pron. this.
    aiv, spot, bolt. ( A. ايو
  ewakhá, alone. (Panj. hekwá.)
                       ن B.
 bádsháh, king. P.
    bár, s. burden, load.
                              P.
        bár-bandagh, to load.
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بادشاه بادشاه bádsháh, king. P.

bár, s. burden, load. P.

bár-bandagh, to load.

bár-er-khanagh, to unload.

báragh, adj. fine, thin, lean. (P. bárík.)

báro, turn. Si.

báre, báre, bárth, 3rd pers. sing. fut. of baragh.

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báz, many, much.
      bázen wájhá, of many sorts.
      bazen barán, often.
      bázen rangá, many coloured.
 bázár, bazaar. P.
  bázú, limb. P.
بازیگر bázígar, juggler.
 básagh, v. to low (of cattle).
  bágh, s. a garden. P.
   بانته bágh, v. p.p. báitha باغ
 bághár, s. a lizard.
 . báqí, adj. remaining. A.
  bál, s. flight.
       bál-giragh, to fly, take flight.
       bál-deagh, to let fly.
  báládh, figure, shape, form.
 báládhiyá, adv. from below, upwards.
  bálagh, of age. A.
bándí, s. a hostage.
 báng, a voice, sound; cock-crow. P.
   bángá, ) s. the morning. Bángawá, in the morning
  bángo, (to-morrow. Thí-bánga, the day after to-morrow.
bángohiná, in the early morning.
 bándan, a rough table.
 báut, refugee.
 báutí, shelter, refuge.
  báhir, s. a herd of donkeys.
 báhrav, s. male calves.
   יבין baphá, scurf. Si. bapho.
  but, self, oneself. (Si. butu, the body).
  bitár, the two stars (forming the tail of Ursa major).
  bathir, better, very good. (P. bihtar.)
  bathlo, wooden mortar.
  بتيرة baterá, quail. Si.
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يم bij, seed. Panj.
   bachh, son. P.
   bakht, fortune.
                        P.
bakhtwálá, fortunate, generous, (used in addressing
           superiors).
    bukhta, p.p. of bushkagh.
   bakhmal, velvet. (P. makhmal.)
      bad, bad (only in Persian compounds).
   bad-khú, ill-natured.
   bad-duá, curse.
  بدشكل bad-shakl, ugly,
    badragá, an escort.
   badí, enmity. P.
    budagh, v. p.p. ندّغ budatha, to drown, be flooded.
           (Si. budanu.)
      badh, s. enemy. Generally in the plural بذوك badhán.
    بدل badhal, s. a debt.
     bar, a time, a season.
            va-bare, once.
            thí-bare, again. Bázen-barán, often.
     bar, s. fruit.
      bar, s. a desert. A.
    biráth, s. brother. Birá maní, my brother!
   barákh, coarse grass found in the lower Sulaiman Hills.
   برافار barádhar, s. brother (poet). P.
 . barádharí, s. brotherhood براذري
birázákht, s. a nephew, (brother's son). P. birádarzáda.
   براوز baráwar, adj. equal.
bardast, s. shoulder-blade (used in augury).
                adj. high. upper, lofty. P.
   ( burzagh برزغ
 burzáthir, adj. very lofty, higher or highest. Comp. of
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burz.

. barzi, s. a bag برزي

baragh, v. p.p. burtha برخ, to carry away, bear off, remove.

P. burdan.

Er-baragh, to swallow.

Dar-beragh, to defend, save.

برغ buragh, v. p.p. buritha برغ, to cut. P. buridan.

burqa, s. a veil. A.

birinj, s. husked rice. P.

baro, 2nd pers. sing. and plural Imperative of ravagh, baroeth, go, go ye. P. burú. Skr. bhrú.

baroth, s. moustaches. (Cf. Pashto bret.)

بريسخ bresagh, v. pp. brestha بريسخ, to spin.

buzí, s. a spring.

بز baz, adj. thick, coarse.

buz, s. a goat. P.

basham, the rains, the month of Sawan.

bushk, s. a horse's mane.

bashkagh, v. p.p. bashkatha, to give. P. bakhshidan.

bushkaqh, v. p.p. bukhtha, to discharge a gun.

baghá, s. coward, runaway.

baghl, s. in the phrase baghl giragh, to embrace. Ar.

بغير baghair, except, without. Ar.

bukchí, horse's mane.

بقال .bakkal, a Hindú, a trader. Ar بكل

bakhú, where ?

bag, a herd of camels. Panj. bag. Si. vagu.

bil, imperative of ilagh. Bil-dai! let go!

bal, spear.

billá, s. medal.

balrú, infant.

. balgo, dirt.

balúghat, puberty. Ar.

billí, cat. Hindi, Si., Panj.

ban, exposed surface of a stratum of rock, sandstone.

bun, root, bottom. P.

buná, below, at the bottom.

band, an embankment. F

bundar, the buttocks. Si. bundaru.

bandagh, v. p.p. bastha, to tie, bind. P. bastan.

Saren-bandagh, to help.

Drogh-bandagh, to lie.

bandíkk, thread.

bunagh, baggage.

banú, an embankment round a field. Si. bano.

binni, a donkey's pack-saddle.

bunyad, foundation. P.

bo, s. smell. P.

Gand-bo, stink.

Náz-bo, pleasant smell.

bot, vermin.

búṭagh, v. p.p. búṭatha, to close (the eyes).

búthagh, bracelet.

bokhta, p.p. of bozhagh. q. v.

bodh, a small tree producing Gúgal gum, Balsamodendron mukul.

אכל bor, chestnut (of a horse); poetically a mare, horse Siboru.

búr, a bud.

borchi, a cook. Turkish.

je! boz, the Gúgal tree, also the drug obtained from it, Balsamodendron mukul. See bodh.

búz, wild, savage.

bozhagh, p.p. bokhtha, to open, untie. (Cf. pázand, bozheshn, release.)

bozhí, a boat. A.

bogh, a joint in wood.

bauf, a pillow, mattrass.

بوكغ bokagh, (1) to bleat as a goat; (2) to be proud, frisky.

bolak, a tribe.

búlí, beestings.

bolí, speech.

bohárí, sweeping. Si. buhárí.

bohtár, a host, entertainer.

bohari, in front. بوهري

bohal, a barren, salt mountain.

bohra, a vault, cellar. بوهرة

bhá, s. price. Si. bahá. bhá-giragh, to buy.

bahá, v. the River Indus.

bahádhur, brave, a hero.

bhágyá, rich, well off. Si. bhágyo.

bihán, a filly.

bhándá, a fold, enclosure, pen. Si. bhándo.

baháí, sale.

bhit, a wall. Si.

بهتى bhattí, a kiln. Si.

bahar, a share. P. Bahar-khanagh, to deal, divide.

baharkhá, the month of Chait. P. bahár.

bhuragh, p.p. bhuritha, to be crushed, burst. Si. bhuranu

bihisht, heaven. P.

bholú, monkey. Si.

bhorenagh, v. to break, burst (transitive). Causal of bhuragh.

Chham bhorenagh, to wink.

Khond bhorenagh, to kneel.

bhedí, s. the ankle. Si. bhedí.

be, pr. without. P.

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be-imán, faithless.
  be-adab, rude,
be-árám, uneasy. برام
be-insáf, unjust.
  be-akul, senseless.
 be-akulí, senselessness.
  be-phádh, a snake, (lit. without feet).
 be-dihán, thoughtless.
be-sanátí, useless. بے سناتی
 be-sek, weak.
  be-shak, doubtless.
 be-shumár, innumerable.
  be-fahmá, unintelligible.
   be-kár, unoccupied.
  be-gunáh, innocent.
 be-miyar, پے میار
                   shameless.
  Le Le be-hayá,
  be-was, helpless.
      bai. Imperative.
    bí, عن bíth, and subjunctive, of bíagh. Cf. Pashto ví.
     bitha. Past Part.
      bair, revenge. Bair-giragh, to take revenge.
    bairí, revenge, enmity.
   berání, harm, damage.
  ber-khanagh, to surround, encompass.
  bero-deagh, to turn back. بيرو دينغ
    berí, a boat. Si.
     begáh, s. evening. Begahá, in the evening.
     ... bílan, s. the small intestines.
     بيل bel, (1) a friend; (2) a hoe.
     benagh, s. honey. Benagh-mahisk, a bee. (Cf. P. angubin.)
            Pashto gabina.
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bing, dog. Bing, the Dog, i. e., the middle star of the three forming the tail of *Ursa Major*. See under Guránd. Bing-mahisk, a horsefly.

bewán, wilderness. P. bayábán.

ליכ שׁ bíokh, possible. Bíokh-nen, impossible. Noun of agency from bíagh.

يينُغ bíagh v. to be, become, p.p. bítha.
Bíagh-ravagh, p.p. bítho-shutha, to become, to suffice.

P.

pátár, a hole dug for roasting meat over.

párá, hog-deer. Si.

párat, charge, entrusting, confidence. Si.

pára, quicksilver. Si.

pád, root. Si.

ياسنا pásná, a night attack.

pák, clean. P.

pákrá, camel's riding-saddle. Si. pákhiro.

pálo, frost. P.

pálenagh, to strain, sift, winnow.

pánjálí, yoke (of oxen). Si. panj.

ياينا páiná, lower, eastern. P.

pat, s. silk. Si.

pat, s. confidence, trust.

pat, s. a bare plain. Si.

bit patáfá, in the heat of the sun.

pital, brass. Si.

patang, s. a moth.

پتاکهه patsákh, oath. Si.

pachul, curtain or side walls of a Baloch hut.

pukht, s. the Bhán tree (Populus Euphratica). See phukht.

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paraddav, s. پرتو
                         echo. Si. parláu.
         parlá, s.
        parútá, adj. stale.
       pazádagh, s. a step-son, (husband's son).
     pasháng, s. a wild man, savage, idiot.
       pashí, s. a berry.
        بكر pakar, adj. necessary.
        palán, camel pack-saddle. Panj.
       لبان palútá, curse.
      palithagh, s. (p. falita). The slow-match of a matchlock.
      pindagh, to beg. Si. pinanu.
      pindokh, beggar. Noun of agency from pindagh.
       panwar, (also much-panwar), the Pleiades.
        por, s. a flood.
       púragh, v. to bury. Si. púranu.
      پوريالا poriyáh, wages. Si. porhyo.
    post, s. poppy. Post-dodá, poppy-heads.
      poshagh, to dress. P.
     poshenagh, to clothe. پوشیذخ
                                (Causal of poshagh.)
      pogokh, the gullet.
        poh, understanding.
                             (Pashto poh.)
    poh-khanagh, v. to explain.
    poh-biagh, v. to understand.
       pha, prep. on, upon, among. P. ba. Pashto. pah. Pársí pa.
                    Pha-wathán, among themselves.
       phádh, s. foot, leg. Demí-phádh, forefoot.
                             Be-phádh, footless; a snake.
                             P. páí. Z. pádha. Skr. páda.
    phádh-ágh, to arise.
phádh-phusht, instep.
   phádh-guzár, shoes.
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phádh-muchh, ankle. بهاذ مجها phádh-murdán, toe.

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phádh-murdánagh, toes. يهاذمردانغ
  phádh-nalí, shin. پهاذناي
   phádhí, ring worn on a woman's toe.
   phádhagh, wheel.
     phár, leisure.
   phárat, charge. See párat. Si.
  phárphugh, a tree, (Tecoma undulata).
   phárí, last year. P. pár-sál.
   phárez, temperate. P. parhíz, safe.
   phásh, bare; phásh-phádh, barefoot.
   pháshan, the male márkhor. P. pázan.
     phágh, turban. Met. The succession to a chiefship. Si. pág.
   phánzdah, fifteen. P.
    pháho, hanging ; a noose.
    phiphar, lungs, lights. Panj. Si. phiphiru.
    phut, hair.
   phiţki, alum. Si.
    phit, prickly-heat.
     phutur, original, genuine, thorough.
     phitagh, to turn sour. Si. phitanu.
    phutak, short, stunted; a dwarf.
  phatrik, a bush, (Grewia populifolia.)
    phith, father. P. pidar. Pahl. pid.
phith-phírú, forefathers.
    phithi, other, another. (In Kachi.)
   phukht. See pukht, (Populus euphratica).
    يجن pnaji, عجن phajyá, } with, in company with.
    phají, پہجی
  phajyá-aragh, to recognize.
     phado, pocket.
    phadeagh, v. p.p. phadátha, to run.
    phadímá, adv. behind.
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phadhá, afterwards.
 phadhí, hinder, coming after.
   phar, prep. for, on account of.
    phar, a wing, feather. P. par.
   phur, full. P. pur.
   pahrá, watch, guard.
 phuráf, a young female camel up to 3 years old.
 pharámagh, to deceive, deceit.
  pahráwan, long coat. Si.
   phráh, broad. P. farákh.
 phráhádh, } breadth.
phráhí, پهراهي
pharchhe, why? on what account?
   phurz, tinder. Si. purdu.
 phirishtagh, an angel. P. firishta.
  phrushagh, p.p. phrushtha, to
                                     break, burst (intr.).
          Cf. P. fursúdan.
 pharmán, command. P. farmán.
   phurú, a moth.
  phuri, a musquito or sand-fly.
  phroh, grey.
  phuri, a drop. پهري
   phroh, a plant, (Sagaretia Theesans?).
 phirenagh, v. p.p. phirentha, to throw, cast. Cf. P. pará-
          nídan, to cause to fly.
    phur, ashes.
 phizádagh, step-son, (husband's son).
   phazhm, wool. P. pashm.
  phas, a sheep or goat. Pashto psah.
  phaso, answer. Pahl. pasukho.
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phisphairi, two days before yesterday. P. pas + phairi q. v. phusagh, a son. P. pisar.

phusht, the back. P. pusht.

phushtí, a chaddar or sheet for wearing.

phashagh, v. p.p. phakká, to cook. P. pazídan and H. pakká.

phaskk, a woman's garment, boddice.

phakká, (1) ripe, cooked ; (2) a boil. H. pakká.

بكي phakkí, anything reduced to powder, and taken down at a gulp with water.

phagaragh, to melt, thaw.

phagen, early in the morning. P. pagáh, dawn.

phul, a flower. Si. Panj.

puhal, a bridge. P. pul.

phulát, steel. P. púlád.

phullagh, to rob, plunder, p.p. phullitha. Si. phuranu.

phulkand, sugar.

phalo, direction, way, side. Si. palau, edge, border. Pashto, ditto.

phalwá, in a direction.

phulúh, nose-ring. Si. búlo.

phallí, section of a tribe.

pahlí, rib. P. pahlú.

phulli, the cap of a gun.

phalithagh, match of a matchlock. P. palita or falita.

phalit, unclean. P. palid or paliz.

phimblí, eyelash. Si. pimbiní.

pahnád, side, direction.

pahnál, flank.

phanch, five. P. panj.

phanjak, one-fifth. (The share of plunder due to a chief.)

phanjáh, fifty. P. panjáh.

pahnwal, shepherd.

phini, calf of leg. Panj.

phaner, curds, cheese. P. panír.

phanerpuch, rennet.

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phawad, a mountain, a peak.
   phúphí, paternal aunt. Si. H.
     phodh, پہوذ phodhán, ) there, thither.
phodhán-demí, the common white bindweed.
       phor, a pipe made of clay, or a leaf of phish, Chamerope
              ritchieana, twisted spirally.
   phost, poppy. P. post.
      phogh, s. chaff. (Cf. P. púk).
     phog, s. a bush, Calligonum polygonoides. Si. panj.
    phogri, s. a goat given as wages to a goatherd.
      phol, s. search, enquiry, demand. Si.
phol-phurs, s. questioning. Si. P.
  phol-khanagh, v. to ask, demand.
      pholagh, v. to search for. Si. pholanu.
     pholokh, v. one who demands, a robber.
      phonz, s. nose. (Cf. Pashto, pazah. Brahoi, bámas.)
    phedáragh, v. p.p. phedáshta, to show.
       phídh, s. heel.
     پېين phedh, here, hither. ) here, hither.
     phedhágh, visible. P. paidá.
   يهيد اغيي phedhághen, is coming. See ágh.
      phidhagh, a plant. A small species of Kuphorbia found in
               the southern Sulaiman hills.
       phír, s. an old man; phírand, an old woman; adj. old.
               P. pír.
        phír, s. the jál tree, Salvadora oleoides. Si.
    phairárí, adv. the year before last. P. pírár-aál.
     phíruk, s. grandfather.
     phírí, s. old age.
     phairi, adv. the day before yesterday. P. pari-ros.
      پېيدغ phisagh, پېيدغ phidhagh, } a small plant. See پېيدغ
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phish, the dwarf palm, Chamærops ritchieana.

phesh, first, before. P. pesh.

pheshí, adj. former, first.

pheshá, formerly, first; pheshá, bundainagh, to forestall.

phígh, fat, grease. P. píh.

phifal, a bush, Daphne mucronata.

phílá, complete, full, perfect.

phímáz, onion. P. piyáz.

phehagh, to thrust; to enter forcibly. Si. pehanu.

phehí, a scaffold (for watching crops). Si.

پياذغ piyádhagh, a footman. P. piyáda.

pithar, a short grass found on the Sulaiman hills, growing between the coarse tufts or gasht.

pech, a screw. P.

paidáish, produce. P.

paighám, a message. P.

<u>ت</u> T.

tábidár, obedient. A. P-

táphuragh, v. p.p. táphuritha, to stumble. Si. thábirjanu.

táj, a cock's comb.

ار tár, wire. H.

tárí, clapping of hands. Si. tárí.

tázím, reverence. A.

tás, cup. (Rare.)

ták-khafagh, to flinch, shy (of a horse).

tálábálá, putting off, postponement. Si. tálo.

tálan, a push. Tálan deagh, to push.

tálo, the palate. Si. tárún.

táh, odd (in numbers, as opposed to even).

دهات táha, inside.

táhath, true, right, correct.

تبيت tabiyat, temper. A.

تيال tapál, post. Si. ţapál.

tráth, a plant (called maitr in the Deraját), Anabasis multiflora.

trán, counsel.

tirtha, mad.

trush, harsh, sour. P. tursh.

taragh, v. p.p. taratha, to swim. Si. taranu.

tarkagh, p p. tarkatha, to cackle.

trund, cruel, fierce, passionate.

tarhán, a young camel. ترهان

تري tri, an aunt (paternal). Panj. Skr. stri, woman.

trí-zákht, a cousin (paternal aunt's son).

trer, dew. Si.

trit, s. bread steeped in milk or soup.

tushna, s. frog.

taghár, a small watercourse on low hills.

تک tak. خکن tap-khafagh. } See ták and ták-khafagh.

tikká, swift, sharp. Si.

tal, mole.

talab, pay. A.

talagh, v. to fry. Si. taranu.

tillí, palm of hand; sole of foot. Panj. tarí.

tamákú, tobacco. تمآكو

tambelá, stable. A.

tumho, a plant, Crotalaria Burhia.

tund, maimed. Si. tudo.

tankh, narrow. P. tang.

tankh, a pass through a defile. P.

tang, girth of a horse. P.

ting-deagh, to drink up.

tung, a hole. See tong.

tangagh, to hang. Si. tanganu.

,thurs تهرس

thars.

fear. P. turs.

thursagh, v. p.p. thursitha, to fear. P. tursidan.

```
tawar, voice, call, speech. Si.
  tawán, a vessel for baking bread. P. tábá.
  tawán, battle, fight (poet).
  tobá, a spring. Panj.
 top, a cap. Si. topu.
  totá, parrot. P.
  tokh, a valley between two parallel ridges, a path through
         ditto.
  taukh, voice, speech ; taukh-tawar, conversation.
  tauzh, adj. bitter, brackish.
  tauzh, s. a bush, Salvadora Persica.
 tosagh, v. See thosagh.
tosenagh, v. Causal of tosagh.
 tof, cannon. P. T. top.
túfak, gun, matchlock. توفك
                           P. tufang.
 tawakkul, dependence, confidence. A.
tong, hole. See tong.
 thákh, leaf.
 thár, dark. P. tár.
tháf, heat. P. táb.
tiháf, waterless. (P. tah, low and áb, water?).
 tháfagh, oven. P. tábah.
 tháshagh, p.p. thákhtha, to gallop a horse. P. tákhtan,
         táz.
tháshí, s. gallopping; Galagh-thashí, horse-racing.
 thála, s. a company.
  thán, which? thángo, whither? thán-rangá, how?
  thán, s. a pack-saddle.
thánwán, s. damage.
thap, wound.
  thar, moist. P. tar.
```

thursokh, a coward. Verbal noun from thursagh.

thursainagh. Causal of thursagh, to frighten.

تهرغ tharagh, to return; p.p. thartha; tharagh-ágh, to come back. throngal, hail.

tharainagh. Causal of tharagh, to give back, send back.

thusi, a small bird.

thusagh, v. p.p. thustha, to faint; to go out (of a lamp).

thash, an adze. P. tash.

thashagh, v. p.p. thakhta, to run, gallop. Zend. tach.

thaghárshoz, a plant.

thaghard, matting made of the leaves of the phish, (Chamorops ritchiana). Cf. Pashto taghar, carpet.

fever, heat. P. tap.

thafar, an axe. P. tabar.

thafagh, to become hot.

thal, a valley, an alluvial plain surrounded by hills.

thul, a fort.

tahláng, face of an exposed rock-stratum.

thaltagh, v. to stammer.

tahlishk, broken edge of an exposed rock-stratum.

tham, ambush. Si.

Tham-biagh, to lie in wait.

tuhmat, slander. A.

نبن thun, thirst.

thanakh, thin, fine.

thango, gold. P. tanka, tanga.

thuni, thirsty.

thau,) thou, 2nd pers. pronoun sing. nom. P. tú. Pash- تهوق tha,) to, tah.

thora, quarter (in fighting). Si.

thosagh, v. p.p. thosta (causal of thusagh), to extinguish, put out.

tholagh, jackal.

tholagh-kunar, a bush, Zizyphus oxyphylla.

ثوم .thom, garlic. Si. Panj. Ar تهوم thi, other, another.

Thí-bare, another time, again.

Thi-roshe, another day.

Thí-kase, some one else.

Thí-bángá, day after to-morrow.

Thi-hande, somewhere else,

Thí-sál, next year.

thir, bullet, arrow; thir-janagh, to shoot. P. tir.

thir-dán, a bullet-pouch.

thíragh, horse's nose-bag.

thegh, sharp, swift.

Theahaf, "swift water," name of a stream.

theghi, all. تهيغي

thfl, age (used of animals).

thelagh, eyeball.

thewaghen, all, the whole.

thíh, a slave (male).

tirband, the constellation Orion.

tez, sharp. P.

tezhagh, a melon. تيروُغ tezhagh. khoh, a hone, whetstone.

telán, a push, shove. Si. thelho.

Telán deagh, to push.

亞 T.

tubí, advice. Si. بي

tapur, felt, namda. Si.

trámá, copper. Si. trámo.

تريخ trapagh, to drop, drip.

trimagh, to drip. Si. trimanu.

trimu-af, dripping well, or small waterfall.

trakaqh, to burst (used of boils).

troredár, a firelock.

tilú, a bell.

tindiní, firefly. Si.

tindiní, firefly. Si.

Tobí deagh, to dive.

Tobí deagh, to dive.

y

topú, hat. Si. topu.

tond, turban, met. a great man.

tong, a hole. Si. tungu.

tháhinagh, to make, construct. Si. tháhanu.

Thíthal, female ravine deer.

thítagh, eyeball.

titúná. the bulbul.

ر J.

titihar, the sand-piper, Tringa goensis.

jáizo, promise, engagement. A. jáiz.

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jat, camel-driver. Si.
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jathir, millstone. Si. jandru.

jatha, p.p. of janagh.

jukht, scabbard of a sword.

jukht, adj. even (in numbers, as opposed to odd). Pashto jukht.

jar, clothes, dress.

jarida, a poor man, pauper.

juzagh, to go, move.

gámá juzagh, to walk (of a horse).

juzokh. Verbal noun from juzagh, moving, the pulse.

jist, zinc. P.

jaghdal, s a Jat.

بغدلي jaghdalí, s. the language of the Jats, viz., Panjábí or Sindhí.

jaghar, liver. P. jigar.

juft, a pair.

juláh, an attack. Si. julah.

(بامانان جبوه

julgav, a crowd.

jumá, Friday. Ar. jum'ah.

jamárá, everlastingly. Si. jamár.

jumb, moving, shaking.

jumla, collection, total, amount. Ar.

jan, s. woman. P. zan.

jan-gal, a band of women.

in jannat, heaven. Ar. e.s.

janthir, jandar, a mill, millstone. Si. jandru.

jind, self, oneself. Si.

wathi jindeghen, one's own.

janagh, v. p.p. jatha, to strike. P. zadan, zan. tárí janagh, to clap hands.

chapol janagh, to slap.

dápurá janagh, to stamp. dighár janagh, to dig. dafá janagh, to boast. dak janagh, to solder. dag janagh, to rob on the highway. dil janagh, to vomit. dang janaqh, to sting. túfak janagh, to shoot. khátr janagh, to breach a wall. ladhagh janagh, to kick. síndá janagh, to whistle. taukh janagh, to cry out. goghrá janagh, to snore. cháp janagh, to clap hands. gwánkh janagh, to call out.

jinkh,) s. a daughter. Dim. of jan. Cf. Pashto jinai, janikh, jinakai.

jang, s. war. P. jung-bilá, a medal.

jo, s. a stream, canal. Pehl. jóí. P. júí. syáh jo, a perennial stream.

jau, s. barley. P.

jawáb, s. answer. A.

jawár, s. a pair, yoke of oxen mate.

jawáin, good.

jawániyá, adv. well.

jodh, a man, warrior.

jor, adj. well, strong, in health. Si. joru.

jaur, poison.

jaur, the oleander, Nerium oderum.

jozho, a small fly. جوژو

joragh, جورع jorainagh,) to make, construct. Si. joranu.

jogh, yoke. Si. jog.

júfá, avarice, usury, A. Si. jyáfa.

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júfákhor, a usurer. جوفاخور
  jogin, a wooden mortar for cleaning corn.
jogindár, stick or pestal for ditto.
   júl, a large bag.
  jauhán, a heap of corn at harvest.
 jhátí, a peep. Si.
   jahár, s. a flock of birds. Si. jhári.
   jaház, a ship. P.
  jihán, the world.
             dehá jiháná, in the whole world.
   jhapagh, to toss up. Si. jhapanu.
  jhatkagh, to sob. (Cf. Si. jhatko, a fit of passion.)
   jhur, clouds. Si. jhuru.
 jhari, of more than one colour.
  jhag, foam, scum, froth, bubbles.
   jhul, carpet. Si.
   juhul, deep.
   jahl, low.
    jahlá, below.
jahl-burz, ups and downs, inequalities.
  jhallí, a pankha. Si.
   ihan, small bird (snipe?)
  jhandá, a flag. Si.
  jhera, a quarrel, Si. jhero.
  jebho, s. armour.
  jait, camel-saddle.
 jedí ) (f.) a companion, associate.
   jídh, s. pasture.
   jígh, s. bowstring. P. zih. Pushto, jaí. Si. jihu.
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& Ch.

chábar, short grass.

cháp janagh, to clap hands.

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chápol janagh, to slap.
     cháth, a well. P. cháh.
     cháragh, v. p.p. cháritha, to look out, spy.
    chárí, a guide, spy. Si.
    chárí ascent, Si. charhí.
    chák-deagh, to split, rip up.
    cháut, threshold. Si. cháunthí.
     chabha, sandals.
chup khanagh, to be quiet.
     chap, left. P.
chap-dust, left hand. P.
chap-chot, crooked.
  chaprúí, an English rupee.
     chapí, adj. left, sinister, unlucky.
     chit, woman's petticoat.
     chat, roof. H.
    chatá khanagh, to grasp, catch hold of with the arms.
      chitar, matting.
       chatagh, p.p. chattha, to lick. Si. Chatanu. Lab chatagh,
             to flash in the pan.
      chați, s. a fine.
     chachho, how?
       char, a path hemmed in by precipices on each side.
       chur, a small hill torrent.
      پرچ charp, adj. fat. P.
     charpí, s. fat, grease.
```

charaz, the houbara, (otis houbara). P.

charagh, to wander, go about. Si. charanu.

chiring, s. a spark. Si. chinig.

charo, merely, only.

charokh, wanderer, vagabond.

chirra, shot.

charainagh, to watch cattle, to graze. Causal of charagh

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chari, madman. چري
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charagh, to ascend, climb. Si. charhanu.

chushma, a spring. P. chashma.

chishagh, p.p. chishatha, to sneeze.

chighird, the babul bush, (Acacia Jacquemontii).

chughal, a spy.

chaghal deagh, to throw away.

chiktar, how much? How many? (Probably for chi chikar,) qadr).

chikagh, to pull, drag. Si. chhikanu.

chukagh, to kiss.

chukh, a child.

chukhchorí, children. چکهه چوري

chakha, on, upon.

chagá, testing. Chagá-hálwar, a laughing matter.

chil, forty. P. chihal.

chillagh, to peel, scrape. P. chalidan.

chillur, peel, bark, scales.

chilkagh, to shine, glitter. Si. chilkanu.

chalgudhagh, bat.

chulumb, s. earring. (Cf. Si. chumbulu.)

chalo, s. a ring. Si. chhalo.

chamb, a spring.

chambaragh, v. p.p. chambaritha, to spring upon. Si. chambaranu.

chambo, ball of foot, claw. Si.

chamra, bat. Si. chamiro.

chamagh, a spring, fountain. P. chashma. See chhamagh.

chaná, opinion. (Cf. P. chanídan.) Main chaná, in my opinion.

chinjú, crowbar.

chund, point of the compass.

chinagh, p.p. chitha, to pick up, gather, collect. P. chidan.

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chang, banjo or guitar. B.
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chot, adj. crooked, bent.

Chot khanagh, to bend, tr. Chot biagh, to bend, intr.

Chot chham, squinting.

choto, a horse-fly.

chawá, jest.

chawagar, jester. چواگو

chúch, little finger. Si. chích.

chaupher, round.

choro, boy. Panj.

chori, orphan. Si. chhoro.

chúrí, chicken. چوري

chofagh, v. p.p. chofitha, to pound, thump. (Cf. P. koftan).

chhath, a well. P. cháh. Z. chittha, pit.

Arra chih, what?

chhil, forty. P. chihal.

chhilav, cold weather (Jan. Feb.).

chham, the eye. P. chashm.

chham bhorainagh, to wink.

chham phusht, eyelid.

chhatar, s. joke.

hechí, anything. P.

chí, s. a thing; chíe-chíe, somewhat.

chyár, four; yake chyár, fourfold. P. chahár.

chyár gíst, 80; chyár kund, four-conered. chyár gíst dah, 90.

chyár phádh, foor-footed.

chyárdah, fourteen.

chyáramí, fourth.

chebar, news.

chít áragh, to be crushed. Si. chitáranu.

chetagh, to repair, mend. Si. chetanu.

chedhagh, a cairn erected to commemorate any notable event. ويدنغ chiklo, a little.

* Kh.

لافرن المفارك المفارك

SD.

dán, corn. P. dána.

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Ula dáná,
  انکوه dánkoh,
  .dání دانی
                       until, up till, till when. (Cf. Si. dání, time.)
dáhanthí,
  وائين dáin.
  dáhn, complaint. Si. dánh.
   داى dái, nurse. P.
  dáima, for ever. A.
  dawagar, s. champion.
  متهائع dathán, s. tooth. P. dandán.
                    dathán-dor, toothache.
     dikh, s. spindle. P. dúk.
    فغ didhagh, p.p. dakhta, to brand.
     )3 dar, prep. out, outside. (P. dar, door.)
 dar-baragh, to defend.
to come out. على المحتوان dar-khafagh, but come out. المحتوان dar-fagh, but come out. المحتوان dar-ravagh, but come out. المحتوان dar-shafagh, but come out.
 dar-khanagh, to put out, expel.
 dar-saragh, to protect.
 درکيز غ dargezhagh, to look out.
     dará, adv. outside.
   ナリン drákh, s. vine. Si. drákh.
   drázh, adj. long. P. daráz.
 دراژاک drázhádh, عراژاک drázhí, }s. length.
    duráh, well, in health.
 duráhí, health.
  دراهیا daráhiyá, a promise.
     durr, good, excellent.
     durr, an earring worn in the lobe of the ear (P. durr, pearl).
  dirjagh, see dinagh, to burst.
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ال ال dard, pain. P.

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drust, all, the whole. (Pashto drast.)
   drishagh, p.p. drishtha, to bite.
   drushagh, p.p. drushtha, to grind.
 درشک darashk, tree. P. dirakht.
   درغ diragh. See dinagh, to tear. P. darídan.
  darmán, s. medicine, spirits, gunpowder. P. dárú, darmán.
 درنزغ dranzagh, to go swiftly (poet).
 drang, precipice.
  drosham, front, foremost part, shape, countenance.
   drogh, false. P.
               drogh-bandagh, to lie.
               drogh-bandokh, liar.
درغ وند droghvand, lying, deceit.
    فروه droh, false. Si.
    druh, all. درة
طاني druhání, pistol.
   فرى darri, out, outwards.
 eris, a Baloch dance, at weddings, and also (called jhamar,)
           rejoicings, accompained with shouting or groaning.
   وريري drin, rainbow.
     jo duz, thief. P. duzd.
  غ duzagh, to steal. P.
ارواك daz-wág, bridle. (For dast-wág.)
فرواهي duzwáhí, friendship.
   نزى duzí, theft. P.
  طرکت dazhak, s. a snipe.
  duzhman, enemy. P. dushman.
                  Cf. Zend. duzh, in duzhda, evil, &c.
 duzhmaní, enmity. P.
 dast, s. hand. P.
               dast-khafagh, to get, obtain, come to hand.
               dast-láinagh, to touch.
               dast-lath, walking-stick.
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dast-khatt, signature.

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كستغ dastagk, handle. P. dasta.
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dastur, custom.

dasht, a barren plain or tableland. P.

Les du'á, prayer. A.

nekh-du'á, blessing.

bad-du'á, curse.

dighar, land, ground, level country. P. dihar. dighár-wázhá, landlord.

dighár-janagh, to dig the ground.

طن daf, s. mouth.

daf-janagh, to boast.

daf-dáragh, to be silent.

dafá-dár! be silent!

رفار dafár. mouthful. .dawar دوار

رفتر daftar, bard. davtar. دوتر

dafsar, cover, lid.

دک dak, join, mending.

dakjanagh, to solder.

مرك dukh, needle's eye.

مکہ dukh, trouble.

دكميا dukhyá, with difficulty.

دک dag, road. Si. dagu.

dag-janagh, to rob on the highway.

دگر duggav, s. eagle.

dil, s. heart, zeal.

dil-janagh, to retch.

dil-shuthí, retching.

dil-gir, sorrowful.

دلغ dalagh, s. boiled rice.

dalko-deagh, to threaten.

فار dillo, an earthenpot, ghará. Si. dilo.

dumb, tail. P. dum.

mazár-dumb, tiger's-tail (a plant).

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dambiro, a Baloch banjo or guitar.
   dambul, a cairn erected in irony to commemorate a shame-
            ful action.
     طري dan, a tax levied by Baloch chiefs.
  danánkará, till then.
    dinagh, کنغ dinagh, مرغ diragh, p.p. dirtha, to tear. P. daridan, din.
   فرحغ diriagh.
    نز danz, dust. (Cf. Si. daj.)
   دنيكر daníkar, till now.
    دنیا dunyá, the world, people.
     do, two. P.
do-gist, forty. See chil.
    دوار dawar. See dafar.
   درازده dwázdah, twelve. P.
dwázdamí, twelfth.
    dobar, the chest.
  dobarán, twice. دربران
    davtar, bard, reciter of genealogies.
    dor, pain. dathán dor, tooth-ache. láf-dor, belly-ache.
    daur, rich.
    dorá, double. Si. duhuro.
   dorokh, ill, in trouble or pain.
   dozakh, hell. P. dozakh. Z. duzhanha. Pashto dozhakh.
  .dozhí درژی
 dost, friend. P.
   doshaqh, p.p. dokhtha, to sew.
   doshagh, p.p. dushtha, to milk.
  doshí, last night. P.
    dogh, p.p. dotha, to fetch water.
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درغين dogkin, pregnant.

daulat, wealth. A.

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dumandil, with two turbans, i. e., a man of distinction.
  فرهون dúhon, smoke. Si.
      dah, ten. P.
   dihán, thought, consideration. Si. dhyánu.
   dhak, hurt, injury. Si. dhaku.
    dahagh, to get, touch.
   dhul, drum. Panj. dhol. دهل
  dahmi, tenth. دهمي
  dhing, powerful.
   dhúr, dust. Si. dhúri.
  dahús, bastard, a term of abuse.
  dhúliyá, dust. Si.
    dí, also. Dí-dí. Both-and.
   بع deb. thumb.
   ديداء díthlo, mist. (P. dúd, smoke.)
     ديي díkh, spindle. P. dúk.
     ديد dedh, an earthen pot. See dez.
     ديد dídh.
                 sight. P. dídár, díd.
   ريدار dídhár.
  دبدرخ dídokh, eyeball.
     دير dír, far, apart, separate. P. dúr.
             dír-zánagh, far-seeing, wise.
     פאַ der, while, time. P. der.
     dez. pot.
    deghrá, large pot. P.
      dem, face. P. adíma.
                              Z. daema.
     demá, before, in front.
      dím, back.
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dímá, behind.

Z. danha. Skr. deśa.

deagh, v. p.p. dátha, to give. P. dádan. dem-deagh, to send.

drik-deagh, to leap.

ilagh-deagh, to let go. sar-deagh, to send away. gon-deagh, to accompany. mán-deagh, to apply. mokal-deagh, to dismiss.

3 D.

dáto, dust. دَاتُّهِ

مَاجِي dáchí, a female camel. Si.

طَفَى dádí, grandmother. Si.

قادَى بوترى dádepotre, descendants of the same ancestor. Si.

قان dán, desert.

مَاندَالي dándálí, a winnowing-sieve.

طَفي dání, time, a certain time.

313 dáh, alarm, war news. Si.

Jo did, frog. Si. dedaru.

قَار dadday, pony, nag. Si. dradro.

تَرْتَغ drattagh, v., p.p. drattatha, to fall. Si. drahanu, p.p. dratho.

drik, jump, spring.

drikagh, to jump.

قركاري drakán, carpenter. Si. drakhanu.

قرگغ dragagh, to canter. (Si. drak).

قروة droh, falsehood, lie. Si.

قروها drohá, false, dishonest.

قسغ dasagh, v., p.p. dasatha, to show, point out. Si. dasanu.

طَال dukál, dearth, famine. Si. dukáru.

digh, pice, copper coin.

dan, by force, violently. Si. danu.

danphúr, a forcible contribution.

dandwar, a tooth-brush.

نك dang, sting. Si. dangu.

dang-janaqh, to sting.

دَرَدَا dodá, poppy-heads.

رَّ أَنْ dod, framework, bones. Panj. hushken dod, a dry skeleton.

قور dor, a pond. Si. dhoro.

أول dol, a bucket. Si. dolu.

Jo daulá, the forearm. Si. doro.

dolo, cooked. قرلو

dolo biagh, to be crooked.

 $\left. \begin{array}{c} dom, \\ dom, \\ domb, \end{array} \right\}$ bard, minstrel. Si.

dombání-áf, mirage (connected with a legend domb-khushtagh, of a minstrel's death).

dong, bottle. قرىك

درنگا dúngá, deep. Panj.

doh, sin, offence. Si. dohu.

doi, spoon. Si.

dháburagh, p p. dháburtha, to stumb.

ر ال ق ال dhál, shield. Si. Panj.

قادر dhakan, cover. Si.

قمكني dhakaní, knee-pan. Si. dhakiní.

dhúnd, skeleton. Si. قهوند

dhing, crane. دهيىك

قَيْمَ dídar, muscles, biceps.

לב, der, husband's younger brother. Si. deru.

قيرَ dír, body, form, shape. Si. dílu.

قيلهو delhú, fruit of the khaler (capparis aphylla). Si. delho.

قيمبهو dembhú, wasp. Si. Ši. أديو dío, lamp. Si. dio.

díhav, leopard.

 ${f R}.$

ráchí, camel-driver. راچي الا rázá, painter.

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rást, true. P.
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rástí, truth. P.

rák, cheek-bone.

rán, thigh. P.

sl, ráh, road. P.

ráhdí, fate, death.

ráhzan, head of a band of robbers. P.

ráhak, cultivator. Panj.

رب rabb, God. A.

rapta, p p. of ravagh, used in the sense of began, begun; its place in the meaning went, gone being supplied by shutha. P.

rikhta, p.p. of rishagh. q. v.

rid, f. sheep (small-tailed). Si. ridh.

غغ radhagh, p.p. rastha, to tear up the ground.

زفغ radhagh, to be beaten, to lose (in war or play).

rudhagh, v. p.p. rustha, to grow, germinate, spring up mount. P. rustan.

razainagh, p.p. razaintha, to make.

رس ras, juice, sap. Si. rasu.

rastar, wild beasts, game.

syáhen rastar, wild swine.

rasagh, p.p. rasitha, to arrive. P. rasidan.

رسيدخ rasainagh. Causal of rasagh.

rashk, lice.

ragh, pulse. P. rag, vein.

ragham, collection of clouds, threatening weather.

raftar, paces. P.

rakh, s. lip.

rikeb, stirrup. P. rikáb.

rag, vein, pulse. See ragh.

rug, precipice.

ralagh, to mix, join. Si. ralanu.

rumb, a run.

rumb zíragh, to run, hurry.

rumbagh, to run away, gallop, race (on foot).

ramba, chisel. Si. rambo.

rumál, towel. P.

ramagh, flock of goats. P. ramah.

) ran, married woman. Panj. rand.

rand, track, path. Si. randu.

sar-rand, comb.

randagh, to comb, part the hair.

runagh, p.p. rutha, to reap. Cf. Pashto, ravdal. Skr. lú.

y) ro, contracted from roth, 3rd per. sor. of ravagh, will go, goes, may go.

ro, contraction for rosh, day, sun. har-ro, every day, always. ro-táf, heat of sun, glare.

روپهسک rophask, s. a fox (uncommon). P. rúbáh.

rophagh, a loud noise.

rúbarú, in the presence of. P.

رث roth, entrails. P. rúda.

rodár, bowstring, fiddlestring.

rodh, high bank of a torrent or stream. P. rúd.

رِدْغ rodhagh. See rudhagh.

رونی rodhin, madder.

rodhainagh, to bring up, educate.

J) ror, calf.

ror-gal, herd of calves.

rozh-gír, eclipse of the sun (from rosh and giragh).

rosh, day, sun. P. roz.

rosh-ásán, sunrise.

rosh-er-shaf, sunset.

rosh-tiká, daybreak.

roshe-roshe, day by day.

roshe-veláe, from time to time.

roshagh, a fast. P. roza.

رغی roghan, clarified butter, ghi. P.

ravagh, p.p. shutha, to go. P. raftan, shuda.

dar-ravagh, to escape.

mán-ravagh, to enter.

biagh-ravagh, to become.

rofro, a fox. P. rúbáh.

rokhanagh, v., p.p. rokhutha, to light, kindle.

romast, chewing the cud.

rúngrá, a narrow hill path.

1) rúh, soul. A. rúh.

rah, edge, edge of knife.

rahnagh, edge or bank of river.

riband, fringe or horse's forehead.

rít, custom. Si. ríti.

rekh, sand. P. reg.

sar-rekh, cold in the head.

rer, رير rer,) rags.

ريز rez, a rope (made of cotton thread).

נילף rezam, blight (of corn).

resagh, p.p. restha, to spin, twist. Pashto reshal.

resinagh, to pursue, chase; p.p. resintha.

rísh, beard. P.

resh, gall (on the back of a horse or beast of burden).

ríshagh, p.p. rikhtha, to pour, spill, scatter, sow (seed).

P. ríkhtan.

ريشينغ rishainagh. Causal of rishagh.

rem, grass.

rem, matter, pus. P. rim.

riagh, cacare. رينغ

; Z.

lj zá, abuse, bad language.

تان zát, tribe, caste. A.

zát. coloured cloth.

تفان عقد المنان المنان عقد المنان عقد المنان المنان عقد المنان المنان

ال zád, many-coloured, variegated.

zágh, v. p.p. zátha, to give birth, bring forth. P. zádan.

يال zál, woman. P.

زامات zámáth, son-in-law. P. dámád. Skr. jámátri. Pashto súm. jamur, s. name of a tree.

zámin, surety. A.

zámingírí, bail, security.

zán, thigh.

زانتهو zántho, a., p.p. of zánagh, knowingly.

zánagh, p.p. zántha, to know. P. dánistan. Z. má. Skr. jná.

zánmur. See zámur.

رايفه záifa, a woman. A.

zákhm, a wound. P.

زفغ zadhagh, wounded. (P. zada.)

j zar, money. P.

zarágh, leech. (Si. jaru.)

zurth, jowar. (Cf. Pehl. júrdák, corn.)

ال zard, yellow. P.

زردو zardo, yolk of an egg.

زردري zardoi, bile.

ين zirde, heart (poet.) Skr. hridi. Zend. zaredhaya.

Pashto zrah.

زرور zarúr, necessary. A.

zirih, armour. P.

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ij zirih, a well.
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زغر zaghar, adj. fresh, quick.

zagharen shir, fresh milk.

zik, a bag or "maskina" for holding gbi. (Si. jik. Pashto zik).

zamistán. See zawistán, winter. P.

زناخ zanákh, jaws. (P. zanakh, chin.)

, ij zanáwar, animal. P. jánwar.

zanjír, chain. P.

zindagh, living. P. zinda.

zinagh, v., p.p. zitha, sintha or zitha, to snatch, take away forcibly.

is zang, s. turnip.

زنگ zang, الله إلى zangál.

zor, force, might, violence, wrong. P.

29; zivir, rough, not smooth. (Cf. Pashto zig.)

zorákh, powerful, violent.

زرواز zorwálá, oppressor, tyrant.

زراد zawádh, scent, smell. P. zabád.

zawár, pebbles. زوار

j'j zawár, rider, horseman. (P. sawár).

zawál, s. injury.

زان zawán, tongue. P. zabán.

zawistán, winter. P. zamistán.

y zah, kid.

zah-gal, flock of kids.

zahr, anger. P.

zahr-giragh, to be angry.

zahr, bitter.

zahrak, the gall-bladder. P. zahra.

zahm, sword.

zahm-band, swordbelt.

zahm-janokh, swordsman. zahm-hand, scar of a sword wound.

zahír, lonely, a stranger. A.

ين zí, yesterday. P. dí-rúz.

ziyání, harm, injury. Pehl. ziyán.

ziyárat, shrine, place of pilgrimage. A.

ين zíth, quick. P. zád.

يدين zithen, quickly.

يخا zaikhá, s. ferns, moss, &c.

zíragh, v. p.p. zurtha, to raise, lift.

zíragh-áragh, to fetch. lashkar zíragh, to lead an army. sáh zíragh, to draw breath.

rumb zíragh, to run, saughan zíragh, to swear.

zím, scorpion.

zen, saddle. P. zín.

zen-kanagh, to saddle.

Zh.

zhángagh, v. to bray.

zhalokh, adj. yellow.

zhala deagh, v. to let go. (See ilagh.)

zhamárá, for ever. See jamárá.

zhinga khanagh, to erect the tail (of a horse).

zhing, adj. erect, perpendicular. Also the name of a Baloch sub-tribe.

.ه مر

سابوس sábún, soap. Portuguese. Ar.

sáth, a káfila. Si. sáthu.

sád, honest. (P. sádá, plain (?)).

sádh, rope (of múnj or dwarf-palm leaves).

sarth, cold. P. sard.

sárí, rice growing or in husk. P. shálí.

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sáz-kanagh, to play (a musical instrument).
 عناكية sákh, oath. Si.
ság, potherb. Si.
ságí, that very one, the original.
  sál, a year. P.
  sálagh, parched corn.
 sálokh, bridegroom.
sámbagh, to favour, nourish. Si. sámbhanu.
  سان sán, stallion, bull. Si. sánu.
sáng, betrothal. Si. sangu.
sángí, spear. Si. sángi.
   sáh, shade. P. sáya.
   sáh, breath, life. P.
           sáh-zíragh, to breathe.
sáhdár, domestic animals.
sáhí, a pause, breathing space, fallow.
              sáhí-deagh, to let land lie fallow.
  sáín, sir, master. Si. Skr. swámi.
 sáinagh, v., p.p. sáintha, to shave.
                 Imperative, sá, sará sa, shave the head.
  subí, autumn.
  sippí, shell. Si.
   sath, a deputation to ask pardon.
 ستى sutí, a musquito.
 sijjí, roast meat.
    sikh, barren land.
  sidhá, straight. Si. sidho.
  sudkagh, to sob. Si. sudikanu.
   sudh, ) knowledge, understanding. Si. sudhi. Pashto sud.
    sadh, a hundred. P. sad.
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sar, a man. Pashto, sarai. sar, s. head, front. P.

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sar-giragh, to set out.
sar-deagh, to send away.
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sar-dar, bareheaded. (Pashto, sadar.) هسردار sar-dár, s. chief.

sarposh, covering.

sar-rekh, cold in the head.

sar-rand, parting of hair.

sar-návagh, the morning star (poet.).

sará, adv. and prep. above, upon, ahead, in front. sará-bai, go in front.

sará-era, adv. from above, downwards.

sarbari, upper.

sarbarí-pahnádhá, on the upper side.

surphadh, اسرفت surpho,) s. (Ar. سرپهن surpho,

surphadh biagh, to understand.

sarjah, pillow.

sursád, provisions, forage. Si. sursát.

saragh, p.p. saritha, to remember.

siragh, to leap, prance. Si. siranu.

suragh, to move. Si. suranu.

sarakh, a kneading-trough.

surgo, speech, song.

saral, a yearling colt. Si. sarlu.

surum, hoof. P. sum.

saring, a track. Si. suringh.

saring-janagh, to track.

sari, a woman's chadar.

saren, loins.

saren-bandagh, to gird up the loins, help. saren-bandí, assistance.

sarinda,) s. a sort of fiddle with seven strings of sheep's سرندو sarindo,) gut played with a horsehair bow. Si. surundo.

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sarina, upper; western. P.
   sarodk, music.
 sarosh, elbow.
  sarak, road. Hindí.
    sazá, punishment. P.
 susti. See suti.
   sushagh, p.p. sukhtha, to burn. (Intransitive.)
   saghár, adj. white-faced (of a horse).
  saghdattá, a small thorny plant.
   saghar, head.
 سغركية sagharkha, a wild species of sinapis.
   سغري saghan, dung of cattle.
هغندان saghindán, paunch, stomach.
   sak, strong, stiff, hard. P. sakkt.
  sakatar, a kind of partridge.
   سكل sakal, beautiful.
sakmardí, manliness, strength.
 sakaní, Wednesday.
   sikhagh, to learn. Si. Sikhanu.
 sikhainagh, to teach. Causal of sikhagh.
   هم saki, extreme, excess.
  سکیاً sakyá, ) very, extremely.
   sag, skill, ability. Si. sagh.
    sil, brick. Si. sir. Panj. sil.
  silband, brick-maker. Panj.
     salám, salutation.
             salám-alaik, (Ar. ساام العايك), salutation on meeting.
   silhe, arms. A. salah.
              silhe-gal, arms and accoutrements.
     samá, understanding. Si. samáu.
   samb, a hole, boring.
               sumb-janagh, to bore.
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sambarái, preparation, readiness.
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sambaragh, to prepare, be ready. Si. sambhiranu.

sumbagh, stitch in the side.

.samundar, sea

sand, barren (of offspring). Pashto shand. Si. shandhi.

sand, a joint. Si. sandhu.

sund, a basket of matting. Si. sundu.

sindán, anvil.

sindagh, v. p.p. sistha, to break.

P. shikastan, shikan.

sanj, harness. Si. sanju.

sanj-khanagh, to saddle, harness.

sang, stone (uncommon). P.

sangband, related by marriage (used of two tribes).

sangatí, companions, following. Si.

sangad, companions, escort.

saní, hemp. Si. siní.

sanghar, necklace. Si.

sawá, except, without. P.

sawad, sight, show.

sawárak, breakfast.

sawas, Baloch sandals, made of the leaves of the dwarf palm.

sawál, question. A.

sawáh, morning. A. sabáh.

sobh, victory. A.

súd, interest. P.

sor, salt, brackish, saltpetre. P. shor.

soren-áf, brackish water.

saudá, bargain. P.

súrah, hero, warrior. Si. Súrihu. Z. súra, strong.

savz, green. P. sabz.

soshagh, v., p.p. sokhta, to burn. P. sokhtan, sos.

saughan, oath.

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sanghan-ziragh, to take an oath.
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súf, apple. A.

sawakk, light (in weight).

sol, the kanda or jhand tree. (Prosopis spicigera.)

somar, Monday. Si.

sonáro, goldsmith. Si.

sauhán, file.

sohná, beautiful. Panj.

sohav, guide, acquaintance.

savav, account, reason. A. sabab.

savavá, on account of.

saweth, white. P. safid.

saháral, skilful.

suhág, young unweaned camel up to six months old (f.)

suhbat, society. A.

sihárí, an awl. Si. síráí.

sahth, jewels.

suhr, red. P. surkh. Pashto súr.

sihr, magic. P.

sihr-khanokh, magician.

sahra, manifest, known, evident. A.

suhv, morning. Ar. subh.

suhv-astår, morning star.

suhel, autumn. The month Assú or Asoj. A. (Sept. or Oct.)

sí, thirty. P.

sai, three. P. sih.

sai-bará, thrice.

sai-kona, triangle.

sai-gist, threescore.

syád, relation.

سيال syál, relation, guest, enemy, equal. (Pashto siál, equal.) syáldárí, relationship.

مياه syáh, black. P.

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syáh-áf, ) perennial stream of water.
             syáh-jo, )
             sváh-már, snake.
             syáh-gwar, "black breast." The black partridge.
syáhí, ink. سياهي
sebak, wholesome.
 sith, profit, advantage. P. súd.
   ser, full, satisfied.
           seráf, satisfied. P. seráb.
   sír, marriage.
          sir-khanagh, to marry.
           sir-biagh, to be married.
           sír-wájh, marriageable.
 serab, shaving.
 sírmugh, collyrium for the eyes. P. surma.
اري sístán, custom.
sesí, the chakor, also the sísí or Ammo Perdix Boulami.
 síshin, needle. P. sozan.
 saiak, one-third.
 síkun, مسیکی síkun, porcupine.
 síkhun, سيخير،
            síkun-tír, porcupine-quill.
selhí, necklace of shells worn by mares, camels, oxen, &c. Si
   sim, boundary.
símándar, neighbour.
 سيموك símsún. See sesí.
 saimí, third.
 sínd, hissing. (Si. sindh, whistling.)
            sindá khanagh, to hiss.
  senz, whistling.
            senzár janagh, to whistle.
senzdah, thirteen. P.
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senagh, breast. P. sina.

sewál, s. rubbish left by a flood.

síh, spit. P. síkh.

tufak-sih, ramrod.

سيها síhá, lead. Si.

sehnagh, v. to bear, endure. Si. sahnu.

síagh, v., p.p. sítha, to swell. P. ámá-sídan.

, & Sh.

shá. See shawá, you. P.

sháthlo, dove.

shákh, branch. P.

shádhí, rejoicing, merry-making. P. shádí.

shár, (Ar. شعر), poem.

shágh, a small tree (Grewia Vestita).

shághá, guitar or banjo. See dambíro.

shál, blanket. P.

shám, the evening meal. P.

shán, power, powerful, honourable. Ar.

shán, for ashán, from that.

'shán-go, thence.

'shán-phalawá, from that direction.

shánd, sign.

shánzdah, sixteen. P.

shánagh, backbone, nape of neck. P. shána.

shankh, stony ground at foot of hills.

sháh, horn.

sháh, king. P.

sháh-murdán, forefinger.

sháhkaptar. See shafkástir.

sháhid, witness. Ar.

sháhidí, evidence.

sháhí, a 2-anna piece. P.

. poet شاعر .sháir, (Ar شاير), poet شاير

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shabchirágh, firefly. P.
   shiddat, disputing, argument. Ar.
    shaddo, a turban (poet). Si. shado.
    shudhagh, v., p.p. shustha, to hunger.
    shudhagh, v., p.p. shustha, to wash, intr.
   shudhí, adj. hungry.
     sharr, good, fine, beautiful.
    shart, gambling. A.
    shurdo, a small species of Dianthus found on the Sulaiman
            Range.
      shará, a law-case. شرا
     sharm, shame. P.
     shuru, beginning. A.
   sharik, partner. A.
  shist, sight of a gun. P.
    shastagh, v. p.p. shastatha, to send. Cf. P. firistadan.
    shash, six. P. شش
  shashumí, sixth.
     shár, poem. A.
    shaghar, sharp, harsh (in speech).
    shaghán, scorn, mockery.
    shiqhin, upside down, topsy-turvy.
                 shighin-biagh, to be upset.
    shaf night. P. shab.
             shaf-chirágh, firefly.
             shaf-kástir, a plant.
                                Sophora Griffithii.
             shaf-khor, nightblind.
  shafánkh, shepherd, goatherd. P. shabán.
   shafak, s. iron peg on which a mill stone revolves.
    shakk, doubt. A.
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ه shakk, doubt. A. شکر shikár, hunting, sport. P. شکاري shikárí, hunter. شکري shukr, thanks. A.

shakhal, tamarisk sugar. (The manna produced in the hot weather on Tamarix articulata and Tamarix gallica).

P. shakar.

shakhal, adj. sweet, fair.

shalwar, } the loose trowsers worn by Balochis.

gwáth-shalwar, puffed up, proud.

sham, boundary, water-parting.

shamb, branch.

shamushagh, p.p. shamushta, to forget. Cf. P. fará-شمشغ shamúshagh, moshídan.

shamol, water-parting.

shinz, the camel-thorn. (Alhagi Mauroram.)

Cf. Pashto. 202.

shanikh, kid (f.)

shav-kash. For shaf-kash, the night-expeller, i. o. Venus, the morning star.

shawá, هوا shawá, هوا sh'á, على sh'á,

shawankh. See shafankh, shepherd.

shodhagh, p.p. shustha, to wash. P. shustan. ján-shodhagh, to bathe.

shoragh, saltpetre. P. shora.

shawashkagh, v., p.p. shawakhtha, to sell. (Cf. P. farokh-tan).

shúkagh, to smell.

shum, miser, avaricious. Ar.

shuhaz-khanagh, to like, prefer.

shahr, town, village. P.

shahúr, good manners. Ar.

sh'í. Contraction for ash-í, from this. sh-í phalawá, from this direction.

shidi, a negro. Ar.

shedh, hence, from here. (For ash-edh.)

shedh-phadhá, henceforward.

shedhá, hence. شيدا

shikhan, s. cloth in which the flour from the mill is collected.

shír, milk. P.

shir-war, suckling, unweaned. shir-deokh, milch.

shir-doshokh, milker.

shír-dán, bladder.

sher, under, from under. (P. zer.)

sher-phalavá, from the underside.

sher-gwáth, leeward.

sher-tharagh, to be crushed beneath.

shezirk, a low furze-like shrub, (Caragana sp.)

shef, slope. P. shib, nishib.

af-shef, watershed, slope of a drainage basin.

shefagh, pin or rod for applying collyrium to the eyes.

Gh.

غرق gharragh, to snore.

غريب gharib, poor, inoffensive. A.

غلث ghalat, mistake, false statement. A.

ghulám, a slave. A.

غم gham, grief, sorrow. A.

غمناك ghamnák, sorrowful. A. P.

غمي ghamí, mourning. A.

ن F.

ال fál, an omen. Ar.

fáida, advantage, profit. P.

firishtagh, angel. See phirishtagh. P.

fark, difference. Ar.

fasl, harvest. Ar.

ألسي falásí, carpet, Ar. فلانه fulána, certain, such a one. Ar

K.

كابل kábil, able. A.

كاتر kátar, dagger.

kár, work, business. P.

لا kárch, knife. P. kárad.

kárcha,

لارى kárí, basket. See khárí.

kárez, underground aqueduct.

kárígar, ox.

kází, the Qází. A.

kása, a measure of corn, one-sixth of a harwar. Contains about 6 sers, 9 chitáks Indian weight.

مدلاً káshid, messenger. A.

نغد kághadh, letter. P.

káfir, unbeliever. A.

kák, Baloch bread baked round a heated stone.

ارا kálrá, flea. Si. káriro.

kámbání, sling.

لا kán, mine. P.

kánderí, thistle. Si. kánderí.

كانوني kánwní, cormorant.

káosh, the month of Asoj.

káhí, ditch. See kháhí.

kabr, tomb. A.

kabul, acceptance, agreement. A.

kubba, a domed building.

kaptagh, v. to attack.

kapainagh, to expend.

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kut, blunt.
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kut, lap.

kutákhanagh, to adopt.

katár, string of camels. A.

kutb, the North Pole.

kutb-astár, the polestar.

katre, a little while. A. qadr.

kuttigh, thorn. كتغ

نتنوخ kuttanokh, thorny bushes. Two or three species of Caragana.

kath, spinning. Si.

kithán, which? what?

kuttí, death. كتى

kutragh, to gnaw.

كتّغ katagh, to dig, conquer, overcome.

كننغ kuţagh, to thrash. Si. kuţanu.

لنكر katakar, sand-grouse. Si. katangar.

kithán. See kithán.

kajagh, v., p.p. kajatha, to cover. Si. kajanu.

kajal, coarse flood grass.

kach-khanagh, to measure. Si. kachh.

kuchtoe, a plant.

kachehrí, an assembly, darbar. H.

كدال kudál, a mattock. Si. kodari.

kadah, a cup. P.

kudhám, s. nest.

kadhen, when?

kur, a stable, Si. kurhi.

karrá, ring, link of a chain. S. karo.

کرپاس karpás, cotton. Skr. karpása.

karákut, noise, rattling, clashing.

لرتا kurtá, long coat. Si. kurto.

kurtí, short coat. Si. kurtí.

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karthagh, mongrel, of mixed breed. کرثغ
kirishk, a slip, stumble. کرشک
kirishkagh to slip stumble. Si bl
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kirishkagh, to slip, stumble. Si. khiskanu.

karkávagh, a thorny plant.

karkani, a kind of grass. كركذي

kirm, insect, worm. P.

karmsákh, blackguard, a term of abuse.

karvelí, the caper bush. (Capparis spinosa.) Si. kalavári.

See godhán-din.

لري karri, an earring. Si.

kirrí, a Baloch hut. Si. Pashto.

kireh, hire, wages. P. kiráya.

kir, ashes. Si. kiri.

kizagh, p.p. kishtha, to leave.

کس kas, any, any one. P. kas.

kase, some one.

har-kas, every one.

kus, vulva.

kisái#, المالي kisái#, المالي kisán.

kisának, very small.

kissa, story. A.

kashk, kaurí.

kshik, dog (m.) کشک

kashkol, faqir's begging dish.

kil, a wart.

kull, all, the whole. A.

kullá-phajyá, altogether.

kal, knowledge, skill. Si.

kilát. (Ar. قلعة), a fort.

kaláí, tin. P.

kaltrí, a saw.

kaldár, of European manufacture, as a gun, a rupee.

13

kulishk, a kind of grass.

kullagh, to cough. See khullagh.

kulaf, lock. P. kufl.

kulo, a small earthen pot. See khulo.

لله kulla, cap.

kulla, a warning.

kam, little, few. P. (Also kham.)

kambakht, unlucky. P.

kumb, tank, pool, rock hollow containing water.

kambar, variegated, stained. See khambar-kambar khanagh, to write.

kumbiqh, s. mushroom. 8. khumbi.

kamina, mean, low. P.

kunt, blunt.

kuntagh, thorn. كىتخ

kanjari, prostitute. Si.

kunjí, key. Si.

لنيت kunchitha, a plant.

kunchith, sesamum. See kwenchigh. P. kunjid.

kund, near. See khund.

كندغ kandagh, a mountain pass. See khandagh.

kandí, necklace.

kundí, a hook. Si.

kindagh, p.p. kindatha, to spread out. Si. khindanu.

kunar, the ber-tree, jujube-tree. P.

dig-kunar, Zizyphus jujuba.

khokar-kunar, Z. nummularia.

tholagh-kunar, Z. oxyphylla.

kany, a virgin. Si. kanyá.

kawat, a young male camel up to 3 years. Si.

كوان kawan, bow. Share of spoil taken in a raid. P. kaman. كوانة kwantagh, to stoop.

kotila, young camel from 6 months to 1 year old.

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kúch, s. pommel of saddle.
kodí, metal cup for drinking.
 kodál, mattock. See kudál.
   kor. See khor.
  kaur, the phaláhí-tree (Acacia modesta).
  koro, whip. H. korí.
korkí, trap, snare. Si.
 kaush, Baloch shoes. P. kafsh. Pashto, kosha.
 kavg, the chakor. P. kabk.
kolmír, an aromatic plant; (Grantea, sp.) Si.
 kontar, a bush. (Grewia, sp. ?).
 kontar, a pigeon. P. kabútar.
  konar, the fruit of the dwarf palm (Ohamærops ritchs-
         eana).
   koh, mountain; stone. P.
           koh-gurágh, raven.
kohí, the female márkhor.
kwenchigh, خوينتيغ kunchigh, til (Sesamum indicum). P. kunjid.
   kahá, cause, reason.
khádí, chin. Si.
khárí, a basket. کہاری
khárighar, an ox.
  khál, a species of salsola. Also the sajjí or barilla manu
         factured from it.
kháhí, a ditch. Si.
 khaptagh, to attack.
khatri, a washerman.
 khat, کہت khatra, } bedstead, charpoy. Si.
                khat-phádhagh, the four stars forming the body
                  of Ursa Major.
khají, the date palm (Phænix dactylifera).
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که که khad, hole, pit. Si.

که khar, ass (f.). P. khar.

که kahar, auger, curse. Ar.

که khar, deaf. P. kar.

که په په له kharphaz, a mattock.

که د په له khard, separate.
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khard-biagh, to be separated.

khurdagh, to be scattered.

kharde, some. (Cf. A. P. qadre).

khuragh, a colt.

kharghá, above.

kharag, the ák-bush, (Calatropis procera).

khargaz, the vulture. Pashto, gargas.

khargoshk, the hare. P. khargosh.

kharo-biagh, to stand up. Si. B.

khuri, heel, hoof. Si. khuri.

khur, stable.

khas. See kas. P.

khishálá, difficulty, trouble.

khishar, cultivation, crops.

khushár, slaughter.

khashagh, v., p.p. khashtha, to draw, turn out, discharge, blow (of the wind). P. kashtan.

phost-khashagh, to flay.

phor-khashagh, to smoke a pipe.

hon-khashagh, to bleed, tr.

líkh-khashagh, to draw a line.

gwáth-khashaghen, the wind is blowing.

khishagh, v., p.p. khishtha, to cultivate. P. khishtan.

khushagh, v., p.p. khushtha, to kill. P. kushtan.

khafagh, v., p.p. khaptha, to fall, lie down. To begin (qualifying another verb in the gerund).

khanaghá khafagh, to begin to do.

er-khafagh, to descend, come down, alight. dar-khafagh, to come out, issue. daryá dar-khaptha, the river has risen in flood.

darya dar-khaptha, the river has risen in i

khakhar, wasp. (Sindhi. See gwamz).

khakhar-mánáro, wasp's nest.

khil, peg or axle on which a millstone revolves.

khullagh, to cough.

khalgar, stony ground; large stones.

khulo, an earthen pot or lota.

کہلي khalí, a small water skin (kid's skin) carried on journeys.
(Si. khalirí, skin).

khaler, the Capparis aphylla.

khalero, wild asparagus.

kham, little, less. P. kam.

khumb, pool in a stream. See kumb.

khambar, variegated, striped, spotted, piebald, stained, (of animals).

khanáwa, a sword, (poet.). Si. khano.

khund, adv. near. S. A piece of ground enclosed by a bend in a torrent bed.

khandagh, s. a pass over a crest or ridge.

khandagh, v., p.p. khanditha, to laugh. P. khandidan.

khanagh, v., p.p. khutha, to do. P. kardan, kun. To be able, can (qualifying a preceding verb in the past participle); e. g., khutha khanán, I can do.

er-khanagh, to lay down, place. el-khanagh, to imprison. áwár-khanagh, to mix. bahr-khanagh, to divide. phol-khanagh, to ask, enquire. phur-khanagh, to fill. jalo-khanagh, to attack. kach-khanagh, to measure.

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gur-khanagh, to run away.
much-khanagh, to collect.
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kahnagh, old clothes, rags.

khanokh. Verbal noun from khanagh, doer.

kahna and kuhna, old. P.

kahne, s. pigeon.

kuhne, s. hip.

khopar, skull. Si. kopiri.

khoprá. The Withiana coagulans used for curdling milk.

khokhar, a kind of wild turnips (Brassica, sp.)

khúdagh, a tripod for cooking.

khaur, a large hill torrent. (Cf. Pashto khwar.)

khor, blind. P.

khorí, pursuit.

khosá, fever. Panj.

khofagh, shoulder. کهوفغ

khofagh juzainagh, to shrug the shoulders.

khofaqhá, the shoulder muscles.

khaulú, a fawn.

khontar, a bush, (Carissa diffusa).

khawinjar, a partridge. کہونجر

khond, the knee. کہونت

khond bhorainagh, to kneel.

khaí,) who ?

khaighen, whose?

khair, ox. کہیر

kahir, the kanda or jhand tree, Prosopis spicigers. See also Sol.

kher, the penis. P. kír.

khaizán, perhaps, may be.

khisagh, pouch, pocket. P. kisa.

khin, the anus.

khíná-phur-biokh, a breechloader.

khindar, naked. khenú, a ball. Si. kheno. kítagh, a water-melon. كيغو kaigho, itch, mange. Si kháji. kílár, unripe fruit of Chamærops ritchieana. kínag, envy, grudge. P. kína. kiwá, in exchange.

G.

gádí, pad, cushion. Si. و gár, lost, destroyed. gár-bíagh, to be lost.

gár-khanagh, to lose, make away with.

gár. See gál, speech. Si.

ارا gárá, quarrel.

gágh, v., p.p gátha, coire.

كال gál, speech. Si. gálhu.

gálwar, conversation, matter of discourse.

gálí, a visit.

gálí, bedding.

ولا gám, a pace.

gámá juzagh, to walk (of a horse).

gap, quicksand, quagmire. Si.

گيهل gaphall, a piece, bit. Si. gapalu.

ينني guttani, retreating.

githá, cheek. گتها

gat, chasm, precipice.

guttigh, the kidney. كنغ gatur. See ghatur.

ينهم guth, the throat.

guţhi, bridle.

گنّی gaţţí, wooden handcuffs.

gaj, a wooden arrow.

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guch, the colocynth gourd, bitter apple. Cucumis Colocyn-
 gadikh, kernel. كدكيه
                                                       This.
 gadobar, maize.
 يني gudí, a toy-kite.
   على gad, female uriál. (See guránd). (Cf. Pashto, gad ram).
   يلا gudá, then, again, and.
  گذي gudagh, to chop, to kill animals, to butcher. Si. gudanu.
 gadí, the middle finger.
   أذ gudh, cloth.
   gar, a pimple, boil.
    gur, s. kaurí.
    gur, running. گر
 gur-khanagh, to run away. Cf. Pehl. giríkht, fled.
   garrá, piebald, skewbald (of a horse).
 grádhagh, v., p.p. grástha, to boil.
girarth, a span (with the thumb and 3rd finger).
  gurágh, crow.
               koh-gurágh, raven.
  girán, heavy, dear. P.
  gurand, a ram. The male urial. (Ovis cycloceros).
 girání, weight, dearth. P.
  .gránz, nostril گرانىز
  gurburá, in a whisper. Si. gurburí.
 gurphugh, small-pox. گريهخ
". garphil, a whirling cloud of dust or "devil."
 girjagh, to catch, seize, p.p. girjítha.
  gardagh, v., p.p. gartha, to return. P. gardidan.
  gardan, neck. P.
gardainagh. Causal of gardagh.
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accept, seize, lay hold of.

bál-giragh, to fly.

giragh, v., p.p. gipta, imp. gir. P. giriftan, gir, to take,

gradhagh, v., p.p. grastha, to cook.

bo-giragh, to smell. hál-giragh, to hear news. zahr-giragh, to be angry. sar-giragh, to set out.

garragh, to roar or bellow.

gurkagh, to growl. Si. guranu.

gurkh, wolf. P. gurg.

gurkh, the Wolf, i. e., the last star in the tail of Ursa major. See under Guránd.

garm, hot, warm. P

granch, a knot. گرنج garand, thunder.

guránd, (1) ram; (2) the male urial (Ovis cycloceros).

Guránd, the Ram, i. e., the first star of the three forming the tail of *Ursa major*. This is supposed to be pursued by the second, the Dog, which in its turn is pursued by the last star, the Wolf.

Guránd-drikh, the Milky Way (lit. the Ram's leap). This refers to the legend of the Ram brought from heaven to take the place of Ismáil when Abraham was about to sacrifice him. The Milky Way is supposed to be the Ram's track.

garandagh, v., p.p. garandatha, to thunder.

girokh, s. lightning.

girokh. Verbal noun from giragh, a taker, creditor.

giroh, s. fife, pipe.

gari, speech, song.

gari, bald. گري

garri, piebald, skewbald (of a mare).

giregh, v., p.p. girentha, to weep. P. girgán.

grih, voice, sound.

zor-gríbá, in a loud voice.

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gar, a precipice, sudden descent, chasm. Pashto, garang.
  gaz, tamarisk. Especially Tamarix gallica.
          gith-gaz, Tamarix articulata. P.
   و و gaz, a vard.
  guzar, makeshift. گزر
 guzrán, maintenance.
gazaren, ought, is necessary.
  guzaqh, v., p.p. gwastha, to pass. P. guzishtan.
              guzaqh-ravaqh, to pass by.
 gazír, miser. گزیر
 gisar, mistake, forgetting. Si. bisiranu.
            gisar-biagh, to forget.
 gasúr, s. anger.
gasht, coarse long grass on the hill side, not eaten by
         eattle.
  gushaqh. v., p.p. gushtha and gwashtha, to speak, say, tell,
         sing, recite. (Skr. vach).
gushokh, singer, reciter.
gishainagh, v., p.p. gishaintha, to choose. P. gizidan.
 يخ gugh, owl. P. buh.
guftár, speech, song. P.
  gwafagh, to weave. گونغ
   gal, cheek. Si. galu.
   gal, a number, quantity. Used in composition to form
         nouns of quantity as jan-gal, a band of women.
   gil, clay, earth. P.
   gul, a flower. P.
   يُعْ galágh, p.p. galáitha, to praise.
gulálakh, long curls worn by Balochia.
 گليهان galphán, a groom, syce.
  galatha, rotten. Hindi, galá.
   gullar, dog's pups. Si. guliru.
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galagh, a band of mares, or of horsemen.

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galagh-tháshí, horse-racing.
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gulgul, water with which the mouth is rinsed after eating.

galo, door. گلو

علم galla, a káfila, caravan. Si.

لاء يا galí, a street. Si.

galim, a rug or blanket. P.

gunás, (rare) گذای

fault. sin. P. gunáh. gunáh, (common)

gunj, crease, wrinkle. Si. gunyu. Pashto gunjah.

ganji, a measure of corn.

gand, s. a branch water-course.

gand, s. filth, manure. P.

gand-bo, stink.

gund, testicles.

gundí, an entire horse.

gandákho, Indian rue (Peganum harmala).

gandraf, sulphur. Si.

غدغ gandagh, bad.

gandagh, v., p.p. gandatha, to join.

gindagh, v., p.p. ديثه dítha, imp. gind, to see. P. bín, dídan.

كندل gandal, s. felt, namda.

gandíl, a short fodder grass in the lower Sulaimáns and plains. Si.

gandím, wheat. (P. gandum.)

گنڌ gand, Adam's apple.

gannokh, fool, idiot.

asulá-gannokh, a born idiot.

go, prep. with. P. ba.

go, s. race, prize.

go-bar, a race-winner.

gwáth, air, wind. P. bád.

gwáth-má, climate.

er-gwáthá, on the leeside. gwáth-shalwar, puffed up.

يواثخ gwáthagh, a gelding. گواثو gwátho. windy.

gwáthen hálwar khanagh, to talk big.

gwarish, rain. P. barish.

gwáz, bark of a tree.

gwash, ground at the foot of a hill.

gwáfagh, v., p.p. gwáptha, to call together, summon. (Cf. P. guftan.)

gwagha, immediately.

gwálagh, packsaddle for oxen, bags.

ganda-gwálagh, (lit. spoil-bags), the small red ant. Also the name of a Baloch sub-tribe.

gwamesh, buffalo. P. gav-mesh.

gwamish, a small plant used in washing.

guwán, doubt, hesitation. P. gumán.

gwanzagh, a swinging cradle.

gwankh, voice, sound. P. bang.

gwankh-janagh, gwan'-janagh,

go-bar, a horse that has won a race.

got, bridegroom. Panj.

goj, a large lizard, "go-sámp." Si.

gwach, a buffalo-calf. Si. vachhi. Skr. vatsa.

gokh, an ox, cow. P. gáv.

gaukh, nape of the neck.

gokhránd, dung-beetle.

gokho, a span with the thumb and forefinger. Si. gonkú

godur, a plant.

godí, mistress, lady. گودي

godh, menstruation.

gwadhán or godhán, udder.

gwadhán-din, the caper-plant. Capparis spinosa. (lit. udder-tearer).

godhar, wasp's nest.

gwar, adv. near. P. bar.

gwará, nearly.

gor, wild ass. P.

gor-dil, *Daphne mucronata* (so called from its red berries).

gor, گور goristan, } tomb.

gwar, woman's breast. P. bar.

gwar-sar, nipple.

gwarán dír khanugh, to wean.

gwar-ambází, embracing.

goránd, a ram, male uriál.

gwarband, path leading round the foot of a hill.

gwarpahar, flock of lambs.

gwaragh, v., p.p. gwartha, fut. 8rd pers. sing. gwárí, to rain. P. bárídan.

gwarakh, a lamb.

gorkhá, a kind of coarse grass called in Sind and the S. Panjáb sin or sain, good for fodder.

goram, a herd of cattle. (P. gáv, rama.) (Si. goramu.)

gúr, gur or coarse molasses.

gwazagh. See كزغ guzagh, to pass. P. guzashtan.

gozhd, fiesh, meat. P. gosht.

gwas, enough. P. bas.

goskari, crystal, felspar; fossils in rock.

gosh, ear. P.

gosh-deagh, to listen, attend.

goshá, s. the pan of a matchlock.

gwashagh. See کشغ gushagh, to say.

goghrá, s. a snore. Goghrá janagh, to snore.

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gwafagh, v., p.p. gwaptha, to weave. (P. báftan.)
gokurd, sulphur. P.
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gomádh, a kind of grass, the seed of which is eaten in times of scarcity, called in Sindh and the Deraját, gam. Panicum antidotale.

> nar-gomádh, a kind of grass with star-shaped flowers, found in the Upper Sulaimáns.

پرمز gwamz, a wasp.

gon, with, together with.

gon-deagh, to overtake. gon-khafaqh, to meet.

gwan or gon, the wild pistachio. Pistacia khinjuk. gwand, short. گرند

گرندان gwandádh, shortness.

gwando, an alligator.

gondosh, s. a large needle.

پنگ gúng, dumb. Si.

gúngrú, turnip. See zang.

goh, a large lizard. Si.

gohár, sister. P. khwáhar.

gwahar, cold. گوهر

goil, s. breakfast-time.

ghat, inaccessible place, precipice.

ghattagh, v. to smother.

ghatúr, a lamb or young sheep suitable for eating. (Cf. Si. ghato, ram).

guhar, adj. See گرم gwahar.

گهریای ghuriáí, s. a stranger. پهریای gharí, hour. Si.

ghal, a band, a raiding party, a raid. Si. ghali.

gahn, a pledge. Si. gahno.

ghoro. A band of horsemen. (Si. ghoro, horse.)

giánch, a small bird found in sandy parts of the country, called Malála in the Deraját.

getra, a kind of melon.

geth, the willow, Salia acmophylla. P. bed.

gethishk, the Sinetta or Bog-myrtle. Dodona viscosa.

gith-gaz, a kind of Tamarisk. T. articulata.

gidh-mahisk, house-fly.

gír. Imp. of giragh, take.

gír, s. memory.

gír-áragh, to remember.

girár deagh, to remind.

gírá, dove. Si. gero. (See sháthlo)

gezhagh, v., p.p. gikhta, to bring forth dead offspring.

gíst, twenty, sai-gíst, 60, chyár-gíst, 80. P. bíst.

gístumí, twentieth.

gísh, s. a female kid.

gíshtar, a shrub, Periploca aphylla.

geshtar, many, more. P. beshtar.

geshin, a sieve. گیشی

gíkár, belch. گیکار

gelar, a squirrel. Hindi galeri.

گين gín, life, breath.

do-gin, pregnant.

gehá, great, good. گيها

gíeshagh, v., p.p. gíeshtha, to pick out, to pay.

, 1 L.

الإيهر láphur, (láf-phur), pot-bellied, pregnant.

الآق lád, sport, play. Si. ládu.

ládá khanagh, to play.

الأر lár, s. crookedness.

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lághar, thin, lean. P.

láf, belly, stomach.

láf-band, belt.

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láf-dor, bellyache.
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láf-ser, bellyful.

الكن lákagh, to bark.

الأل lál, ruby. P.

النب lánav, lana, (Salsola sueda). Si. láno.

lándav, adj. fat.

النك lánk, a waisteloth, dhoti. Si, láng.

الأورا láwará, young of animals.

الينغ láinagh, v., p.p. láitha, to touch, apply. Si. láinu.

lab, the priming of a gun. Si. labu.

lab-chatagh, to flash in the pan.

labz, promise.

labb, obtaining, getting. Si.

latáragh, to rub off, dismiss, get rid of. Si. latáranu.

lath, stick, rod, flail. Si. lathi.

lath, embankment. Panj.

الله lathná, bag for drugs.

laj, shame. Si.

luch, wretch, profigate. Si. luchu.

lid, horse-dung. Si.

ladagh, v. to run away.

ludagh, to move. See lodagh. Si. laranu.

ladagh, p.p. ladatha, to lade beasts of burden, to march, start. Si. ladanu.

نا ladh, jungle.

لغز ladhagh, kick. P. laghat.

ladhagh janagh, to kick.

lar, a branch of a tree.

lar, a sword.

larzagh, to tremble. P.

p.p. larzitha.

larkagh, to hang (intr.). Si. latkanu.

larkainagh, to hang (tr.).

las. all, the whole.

lashkar, army. P.

lagham, horse's bit. P. lagam.

laghadh, kick. See لغذ ladhagh.

laghar, áf-laghar, a rapid or water-fall.

laghushagh, v., p.p. laghushtha, to slip, slip out. (Ar. laghz, slip).

laghor, adj. wretched, mean, cowardly, poor.

laghoren dighár, poor ground.

laghoren daddav, a wretched pony.

lak, a hundred thousand. P.

likagh, to hide (intr.). Si. likanu.

lakauri, butterfly.

likhagh, to write. Si. likhanu.

likainagh, to hide, conceal. (Causal of likagh.)

lalla, s. lisping.

lalla khanagh, to lisp.

lammá, south. Pani.

lamb, a branch.

lambí, s. a kind of grass, (Cenchrus eclimatus?)

anj, blood. لنج

lang, adj. lame. P.

lang, s. a torrent.

lawashagh, v., p.p. lawashtha, to drink.

hon-lawásh, bloodthirsty.

mar-lawásh, cannibal.

lop, s. branch of a valley; a small alluvial plain in the bend of a stream.

loth, s. a bag.

lotagh, v., p.p. lottha, to demand, to want.

lodagh, v., p.p. lodatha, to move, shake, (intr.). Si. lodanu.

lodainagh, to shake (tr.). Causal of lodagh.

lúr, s. hot wind.

lawar, s. a stick.

lúraháf, s. a stream which runs occasionally. Floed irrigation.

lori, s. a minstrel.

logh, s. home, household; (met.) family, wife.

logh-wázhá, goodman, master.

logh-bánukh, housewife, mistress.

laundrí, s. the temples. Si. laundirí.

loh, s. hot wind. Si. lúh.

lohigh, s. a small pond.

lahar, s. a hill-torrent.

ft lahm, adj. timid, bashful.

lihef, s. a blanket, quilt. P. liháf.

letagh, v., p.p. lettha, to lie, recline. Si. letanu.

lero, s. a male camel (full-grown).

اليكهة líkh, s. a line. Si. lík.

líkh khashagh, to draw a line.

lekhagh, v., p.p. lekhtha, to count, reckon. Si. lekhanu.

lekho, s. account, reckoning. Si.

ا ليلس lílhá, a bush, Daphne mucronata. (See phífal, gordil).

límú, s. lemon. A.

lev, s. play, sport. A. la'b. Pashto lobah.

lev khanagh, to play.

М.

má, pro. we, plural of mass.

mátún, s. stepmother.

máth, s. mother. P. mádar. Pehl. mád.

máth-phith, parents.

mákhta, adv. immediately.

mádhagh, adj. female. P. máda.

mádhin, s. mare. P. mádián.

már, s. snake. P.

syahmár, cobra.

már-val, a kind of creeper.

márifatá, prep. by means of. A.

márí, a house with an upper storey. Si. márí.

mázáth, s. a two-year-old camel. (Cf. Si. májádu.)

másí, s. maternal aunt. Si.

másh, s. dál. P.

máshagh, s. the hammer which holds the match of a match-lock. Si. másho.

mákúrá, s. vermin. (Cf. Si. mákoro, black ant.)

mál, s. cattle. A.

máldár, cattle-owner. P.

málím, known, clear. A. málúm.

mámá, maternal uncle. Si. mámo.

mán, prep. in, into.

mán-ágh, to be applied, touch, reach (lagná).

man-deagh, to apply (lagáná).

mán-rashagh, to attack.

mán-ravagh, to enter.

mán-khanagh, to put in.

mán-guzáragh, to meet together.

mánagh, v., p.p. mantha, to tire, become weary. P. mándan.

máh, s. a month; the moon. P.

máh-ghumá, eclipse of the moon.

máhigh, an udder.

máhkán, s. the moon.

mahkání shaf, a moonlight night.

máhlo, early in the morning.

máhí, fish. P.

matbal, meaning, selfishness. (Ar. matlab.)

.matbalí, selfish متبلى

math, death.

mathagh, v. to shake (a churn). Si. mathanu.

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mat. equal. Si. matu.
mattainagh, v. to exchange, barter. Si. matáinu.
majál, power. Used as an expression of apology or re-
        pentance. A.
majális, society. (A. majlis.)
  much, assembled. (Si. muchu, a heap.)
           much-khanagh, to assemble, bring together.
           much-biagh, to assemble, come together.
muchh, joint.
             phádh-muchh, ankle.
             dast-muchh, wrist.
muchí, assembly.
 makhta. See makhta, immediately.
   mudd, season, time. (A. muddat.)
madrik, bead.
 madí, goods and chattels. Si.
 madhakh, locust. P. malakh.
  madhagh, v., p.p. mastha, to freeze, curdle. P: mastan.
   mar, man. P. mard.
           mar-khushokh, murderer.
           mar-khushí, murder.
           mar-lawásh, anar-wár, cannibal, man-eating.
  murád, aim, object. A.
marái, gums.
murján, pepper.
  mard, man. P.
murdán, s. finger.
                sháh-murdán, forefinger.
                nyámaghí murdán, middle-finger.
murdánagh, the fingers.
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phádh-murdánagh, the toes.

mardum, a man, human being. P.

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,marden مردين
                 human, belonging to man.
 mardena.
 marzi, pleasure. A.
  murgh, bird. P.
  miragh, v., p.p. murtha. Imp. mír, to die. P. murdan.
   ሄጐ marká, s. a deputation.
  markhav, a horse. P. markab.
margáví, curse.
 murvádhir or murwhádhir, pearl. P. marvaríd.
 יפרו מ maroragh, to twist. Si. maroranu.
marvehi, see! behold! (an expression of astonishment).
maroshí, to-day. P. imroz.
  miránd, مزاند miránd, مراند miráo, ) أو
  maráí, however.
  miragh, v., p. p. miratha, to fight. (Cf. Si. midanu, to
   יניל mirokk, s. a fighter.
 mazágiragh, to taste. P.
   mazár, tiger, &c. Pashto mzarai.
              mazár-trap, tiger's leap! The name of a game
                resembling draughts played on a board.
   mazain, } great, large. Zend. mazdáo. Skr. mahá. P. mih.
    mizil, stage, march. P. manzil.
     muzh, mist after rain.
   mizhagh, v., p.p. mishtha, to piss.
                Cf. Pashto mítal. Imp. mízhah.
  mazhg, brain. P. maghz.
   mizhguzh, a small plant found in the Sulaimán range.
   mizhagán. See mishásh.
   mas, ink. Si.
   mastar, large, greater. (Comp. of mazais.)
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mastagh, curds. (From masta, p.p. of madhagh.)
 mustí, coarse sugar or molasses, gur. Si.
   masará, in front.
 misk, s. musk. P. mushk.
 misk. See mahisk, fly.
masit, mosque. A. masjid.
 mushádhá, s. show.
mishásh, eyelashes.
 mashal, torch. A.
 musht, s. fist. P.
 musht, s. hilt of a sword.
  mashar, celebrated. (A. mashhúr.)
  mishagh, v., p.p. mishta, to suck. (Cf. Ar. mizz.)
  mushagh, v., p.p. mushta, to rub. (Cf. A. muzz.)
 mashk, water-bag, mussuck. P.
 mushk. See múshk.
  mikráz, scissors.
makherná, fringe over horse's eyes. See riband. B.
malámat, rebuke, punishment, curse. A.
  maláikh, angel. A.
malandrí, warrior. (Poet.)
    mam, the black bear.
   man, I. P.
   us manná, forbidden. Ar. mana.
   minná,
              ease, security. (Poet.)
  minniyá,
  manán, to me, me.
 minnat, entreaties, supplication.
   mind, daughter (among the Marris).
   mund, spring of water.
mundrí, ring. Si. mundrí.
  mundo, altogether, entirely.
mandíl, turban, lungí.
```

du-mandil, a respectable man.

munsif, just. A.

managh, v., p.p. manitha, to attend, mind. Si. mananu.

maní, my. See also main.

mavárkí, congratulations.

moth, star on the forehead of a horse.

moth, moth. (Dál). (Phaseolus Aconitifolius) Si.

mochí, a leather worker. Si.

mokho, spider.

mokho-logh, spider's web.

mor, ant. P.

morband, spotted.

mozhagh, a boot, legging. P. moza.

mosim, season. A. mausim.

múshk, rat, mouse. P. músh. Skr. múshika.

Pashto mazhak.

moshin, butter.

mokal, leave, permission to depart. A.

mokalainagh, to take leave. Old Hindí mukkalná.

molid, a female slave.

momrez, spur.

momand, merciful.

mah, I. See man.

mihrván, friendly, kind. P. mihrbán.

muharí, foremost, in front. Si. muháro.

mahar, corpse.

mahisk, fly. (Cf. P. magas).

benagh-mahisk, bee.

bing-mahisk, horse-fly (lit. dog-fly).

gídh-mahisk, house-fly.

ásk-mahisk, blow-fly (lit. deer-fly).

mahl, patience, leisure. A. mahlá-dár, be patient.

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VOCABULARY.
                                               Extra
 muhlat, time, while, opportunity. A.
 mihmán, guest. P.
mihmání, entertainment.
  mahairá, in welfare, all's well. Answer to the salutat
         biyá durr'shákhtaghei.
   mayár, shame.
   mech, hint, making signs. Si. mechh.
            dast-mechdeagh, to beckon.
mekhmár, mallet. Si.
   mídh, goat's hair or beard.
   medh, a boatman.
  mero, s. assembly.
  mezagh. See mizhagh.
mesk, a small plant, also a kind of soap made from it, used
         in cleaning jewellery.
 mesh, sheep. Especially dumbas.
 maighí, pregnant.
  míkagh, to mew.
  megar, flock of sheep.
  mel, meeting. Si.
menthagh, wet.
  mainar, a kind of grass.
 minhav, a tree. The wild horseradish tree_
         canensis.
  maivar, a bush, (Grewia villosa?).
```

mevo, a chief, leader.

meva, fruit. P.

meh, peg. P. mekh.

mehar, flock of sheep.

mehí, buffalo. Si.

main, my. See mani.

, N.

U ná, not, (un —, in composition).

ná-báligh, minor.

ná-paid, uncommon.

ná-duráh, ill.

ná-sahí, unknown.

المالات ná-kámá, helpless, under compulsion.

الایک ná-láik, unworthy.

ná-wash, unhappy.

náchíken, a little.

nákhun, nail. P.

nákho, uncle (paternal).

nákhozákht, cousin. (Paternal uncle's son.)

نارغ náragh, v., p.p. náritha, to groan.

náz, s. a horn (to blow).

náz, pleasant, pretty. P.

názbo, sweet scent. P.

názuk, delicate, tender. P.

násh, snuff. Si. nás.

náfagh, the navel. P. náf.

nál, horse shoe. A.

nám, name. P.

am-nám, namesake.

انان náná, maternal grandfather. Si.

nání, maternal grandmother. Si.

návarish, anything eaten as a relish with bread.

nabí, prophet, A.

napt, s. lightning. (Met.) a gun. (P. naft, naphtha.)

inipúragh, v., p.p. nipúratha, to wring. Si nipúranu.

nuth, s. face.

nakhinbokh, s. bedclothes; clothes given by a host to a guest.

```
nakhif, slave.
    radhakh, lemon-grass, (Cymbopogon iwarancusa).
     nar, male. P.
     i nar, fife, pipe.
                      Si. narí.
     narm, soft. P.
    nirwar, justice, decision of a disputed case. Si. nirwaru.
    naryán, a horse (m.).
  naz-khanaqh, v. to close, bring together.
    .nazí نزی
                 near. P. nazdík, nizd.
    نزيخ nazíkh.
    nishar, brother's wife; daughter-in-law. Skr. snusha
           Pashto, nzhor.
   nishán, mark, standard. P.
nishtejaní, bedding.
 nishtainagh, to spread out. Causal of nindagh.
   nashk, mark, sign, distinction. A. naqsha.
     nigháh, sight, show. P. nigáh.
    nuqhur. See noghar.
     nughra, silver. P. nukra.
  nughraená, of silver.
    naghan, bread. P. nán.
    nighor, side, direction.
   nighoshagh. See nigoshagh.
     انما nafá, profit. A. nafa'.
   nafuskh, stepdaughter.
     nukrá, white (of a horse). P.
   nikragh, to separate, part (intr.).
    nakl, imitation, copying. A. naql.
              nakl-khanagh, to imitate.
    nakh, نکیه
                ) old woman.
    nakho, نکیو
                    ditto.
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inigáh, care. P. nigáhbání, carefulness. nigoshagh, to listen, attend. Cf. Pashto, nghwatal.

p.p. nigoshtha.

nalí, s. the forearm. Si. narí.

phádh-nalí, the shin.

nalí, s. the barrel of a gun. Si.

namásh, prayers. P. namáz.

nambo, the búí plant, Crotalaria burhia.

nambí, s. fresh feeling in the air after rain.

namak, in namak-harám, traitor. P.

namúna, pattern. P.

nang, honor, dignity. P.

i nangár, plough.

nangár bahagh, to plough.

nindagh, v., p.p. nishtha, to sit, dwell, stay.

P. nishastan, nishin. Pashto, nástal.

er-nindagh, to sit down.

نواسخ nawásagh, grandson, granddaughter. P. nawása. نواشخ nawáshí, to-morrow.

nawáshí-begá, to-morrow evening.

i nawán, perhaps.

nautiren, a game resembling gobang, played on a board.

nokh, new. The new moon, the moon. P. nau.

naukh, a bride. Pashto, náve.

nawad, felt. P. namda. Pahl. namad.

nodh, rain clouds, rain.

nor, mungoose, ichneumon. S. noru.

núrá, silver.

navz, pulse. A. nafs.

núzd, فوزد núzdah, dineteen. P.

noghar, فوغُر or skirt of the hills. nughur,

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nok, beak of a bird.
   naukar, servant. P.
 naukarí, service. P.
     nah, no, not. P.
     & nuh. nine. P.
   nahar, canal. A.
   nuhram, ugly.
 nahmat, intention. A.
  nuhmí, ninth.
   أمي ní, anow. Pázand nun. Pashto nan. المين nín,
  nyádhagh, v., p.p. nyástha., to post, establish, appoint.
          P. nihádan.
   nyám, middle. P. miyán.
             nyámá, in the middle.
nyámjí, one who goes between, arbitrator.
  nyámagh, middling, in the middle.
 inyánwán, in the middle, in (from nyámá).
  niyat, object, desire. A.
   i nekh, good. P. nek.
            nekhen du'á, prayer.
nermosh, noon (for nem-rosh). P. nem-roz.
    nír, s. roast meat.
   inezagh, spear. P. neza.
nestá, ) was not.
nesten, is not.
 nestkár, poor, destitute. P.
  nesh, tooth. (Si. Pashto, nesh, tusk.)
  neghar, in the direction of. See nemgha.
  nékah, marriage ceremony. A. nikáh.
   nílagh, blue.
    nem, half. P.
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nem-ráh, halfway. nem-shaf, midnight.

i nemagh, butter.

nemghá, in the direction of, towards.

nímon, lemon. A.

inen, no, not.

nína, modern, belonging to the present time.
nína-vakhat, now-a-days. See ní.

, W. V.

wájá, وأجا wájá, } like, resembling.

war. (In composition) eater. P. khor.

mar-wár, man-eater. shír-wár, suckling.

wáris, heir. A. wárith.

wázhá, lord, master, sir. P. khwaja.

dighár-wázhá, landlord.

logh-wázhá, goodman.

vágú, a large lizard, alligator. (S. vághú, alligator.)

vágí, that very one. S.

wám, debt. وام

wámdár, debtor.

vánij-vápará, give and take, buying and selling (uncommon.) Si.

wándá, leisure. Si. wándo.

wánagh, v., p.p. wántha, to read. P. khwándan.

wáhú, outcry, the alarm.

wabáh, cholera. (Ar. wabá, pestilence.)

wapsagh, v., p.p. waptha., to sleep. P. khuftan, khusp.

waţ, wick. Si. vaţi.

wattá, stone. Panj.

vitthí, space, interval. Si. vithí.

wath, self, oneself. P. khud. Skr. swad-iya. وثاني wathi, one's own, own.

vakht time. Ar. waqt.

ق, wad, increase.

vadáinagh, to increase. Panj. vadáwan.

رقرى vadrí, leather strap. Si. vadhí.

رقرى vadrí, bribery. Si. vadhí.

بن wadh. See وت wath, self. P. khud.

ردى wadhi, birth.

wadhi khanagh, to foal.

warbariyá, excellently, stoutly.

ward, food.

waragh, v., p.p. wartha, imp. bawar, to eat, drink.
P. khurdan. Skr. hvar.

warná, youth, young man. P. barná.

warú, beam. Si. waro, rafter.

warainagh, causal of waragh, to feed.

رس was, strength. Si. wasu.

be-was, helpless.

وسر wasar, wild onion. See whasar.

wastad, master of a subject, skilful. P. ustad.

wasarzákht, brother-in-law. Cf. P. khusar, záda.

wasarik, father-in-law. P. khusar.

wasariyá, in front, foremost.

wasam, inhabited. Si. wasanw.

wasi, mother-in-law. P. khusú Skr. çvaçrú

wash, sweet, happy. P. khush. Skr. swadu.

washki, male of any beast of chase.

washi, sweetmeats.

vakil, agent. A.

رل val, creaper. Si. vali.

vanní, bride. Si.

vanní, name of a plant.

vanijagh, v. to yield up.

vinyainagh, v. to spoil. Si vinyáinu.

whádh or wahádh, salt.

whár, dirty, foul. P. khor.

whán, tray, dish. P. khwan.

wháv, sleep. P. khwáb. Z. qafna.

whard, food. P.

whard, food. P.

whasar, the wild onion, Allium rubellium. A.

ves, clothing. Si. vesu.

velá, time. Si. velo.

vehí, street. Panj.

8 H.

ماجى hájí, pilgrim. A. هاجي † hákh, earth, clay. P. khák. hádhir, heart. Ar. khátir. háragh, dates. P. khárik. ماضر házir, present, Ar. هازر hásh, double tooth. (Cf. Pashto ghásh). lėla bághá, awake. الله hál, circumstances, new. A. حال. hálá dai! give the news! hálwar, conversation. hámagh, raw, unripe, uncooked. hán, khán, chief. P. khán. هباسي habásí, (عباي 'abbásí), an eight-anna piece. habar, discussion, conversation. P. khabar. habkagh, v. to stutter. Si. habak. hapt, seven. P. haft. haptagh, a week. P. haftá.

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haptumí, seventh. P.
  hatar, danger, apprehension. Ar. khatar.
 hat, shop. Si. hatu.
 hath, the wild olive, Olea cuspidata.
    huch, horse's hough. Si. khuch.
 hachho, thus, so. P.
 hachí, any. Often contracted to 'chí. P. hech.
hadíragh, to chop up.
    had, bone. Si. hadu. Pashto, had.
 هدكي hidkí, hiccough. Si. hidikí. Pashto hatkaí.
   hudhá, God. P. khudá.
 hudháí, هذاي
 hadhen, then.
    hir, a young male camel up to six months.
    har, every, each. P.
           bar-do, both.
           har-rangá, of every kind.
           har-ro, daily, always.
           har-sál, every year.
           har-kas, every one.
           har-ki, every thing that -, each.
           har-vakhtá, always.
           har-handá, everywhere.
    hur, adv. apart.
                hur-janagh, to drag apart.
  harb, jawbone.
  hartál, arsenic. (Si. hartálu, yellow orpiment.)
 hartel, large saddle bags.
hurjín, saddle bags. P. khurjí.
 hirdik, squirrel.
hardhát, metal. Skr. dhátu.
 hirs, avarice. A.
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harsha, a cubit.
 ,harsh هرش
  harragh, s. an infirm person.
 harragh, s. a saw.
 harf, letter. Ar.
harmzáda, bastard, scoundrel. A. P.
harnoli, dhatura.
  harwar, a measure of corn containing nearly 10 maunds
          Indian weight. P. kharwár.
  ,harrí هري
  مري narri, ) mad (of dogs).
  hazhdah, eighteen. P.
  hizhgar, anywhere.
  has, an ornament, a "hassi" or silver necklace. Si. hasu.
 hastal, mule.
 hasht, eight.
  hushtur, camel, (the generic term). P. shutur.
          Skr. ushtra. Brahui hueh. Zend. ustra. Pashto úsh.
مشتم hashtumí, eighth.
   hushagh, p.p. hushtha, to dry (intr.).
  hushk, dry. P. khushk. Skr. çushká. Z. huska.
              hushken dod, skeleton.
 hishki, scarlet.
   هک hak, rights.
   مكل hakal, drawing.
    hakalaqh, v., p.p. hakalatha, to drive, to urge on.
     hukm, (A. hukm), order.
    hal, melting; hal biagh, to melt, thaw.
    hil, a kite. Si.
   hulás, free. P. khulás.
   halk, village, collection of huts. (Cf. Ar. khalk, khalkat.)
    haledh, spices.
  halení, adv. undoubtedly.
  hambácha, ammunition pouch. Si. hambácho.
```

hambár, a collection of corn, and enclosure round it.

P. ambár.

hamodhá, there, in that very place.

hamedhá, here, in this very place.

hamesh, this very one.

hameshiya phar, on this account.

han, neighing, whinnying.

han-khanagh, to neigh, whinny.

hinjri, the shoulder-blade. See bardast. Si. hanjhi.

hinjír, fig. (P. anjír.)

hanchho, thus, so. P.

hand, s. place, dwelling. (P. khána.) (Si. handhu.)

handá, in place, instead.

thí-handá, elsewhere.

har-handá, everywhere.

hech-handá, anywhere.

hech-handá nez, nowhere.

handiyá, somewhere.

ya-handá, in one place, together.

ás-hand, fire-place.

zahm-hand, scar of a sword-wound.

hind, bitch.

hindí, weapon.

handainagh, to be useful.

hunar, skill. هغر

hinkagh, to neigh.

hangar, charcoal. (Cf. Sindhi angaru.)

hingalo, variegated. (Si. hingulú vermilion.)

hau, yes.

hawán, that. (P. ham-án.)

hawankar, as much as that.

hawango, thither.

hot, hero, warrior.

```
haud, tank. Ar.
    by havdah, seventeen. P.
 hodadár, official (for P. uhdadár).
    hod, hole, cave, den.
    haur, rain. Si. horu.
  hor, هوز horg, هورگ horgin, هورگ
 horjín. See hurjín. Saddle bags.
   hosh, sense. P.
   hoshagh, s. an ear of corn. (P. khosha.)
  hoshyár, skilful. P.
   hauf, leprosy; a severe illness, violent fever.
hol, هول هول المول hol, armour, accoutrements. Si.
  hom, the air-plant.
     hon, blood. P. khun.
   hawesh, this, this one. هويش
    hawen, adj. this.
     مي þí. See hídhishk.
     hai, or.
             hai hai, either, or. (P. khwáh, khwáh.)
      hayá, shame. A.
               be-hayá, shameless.
   hait, camel's pack-saddle.
   hith, green corn, khasil. P. khawid.
     hech, any. P.
   hechí, anything.
               hechí na, 'chí na, 'nothing, none, not at all.
      híkh, swine. P. khák.
      hedh, sweat. (Skr. svid. P. pa-sina.)
 hidhishk, the khip bush, Orthanthera viminea.
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هير hír, a houri. (Ar. húr.)
hair, welfare, (Ar. kkair.)
hair khanagk, to salute.
ma-hairá, all's well.
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هيران hírán, dish, plate.

hírth, fine, thin.

haiza, cholera.

hízhokh, a waterfall.

hes, rust, dirt.

híl, hope.

helák, tame, subdued, accustomed. Si. heráku.

hilwand, hopeful.

hínz, a leather churn.

hinzár mathagh, to churn.

hína, weak. Si. híno.

.Y می

ياژنه yázhdah, eleven. P. ياژنه yázhdumí, eleventh. P. يتيم yatím, orphan. A. yakín, certain. A.

yak, one. P.

yak-áptiyá, one another. yake, only one. yake-chyár, fourfold,

yake-chyár, fourfold, yake-sai, threefold,

yala deagh, to let loose. See بله ديئغ yala deagh. Pashto, yalah.

yamárá, for ever. See jamárá.

ya, one. Cf. Pashto yau, yavah.

ya-bará, at once.

ya-bare, once.

ya-rangá, of one sort. ya-handá, in one place, together.

SPECIMENS

OF

THE BALOCHI LANGUAGE.



I.

The Wanderings of the Rind Balochis.

[This poem is very widely spread, and I have met with it in almost every Baloch tribe. The versions differ very slightly. The present one, as the dedication in the last two lines shows, was recited to Jalál Khán a former Chief of the Leghárís. Another version, from a Gurchání Dom, similarly brings in the name Nihál Khán. The poem is probably of considerable age; it is very elliptical in expression, many of the grammatical forms are antiquated, and the versification is loose and formless. It gives the legendary account of the Wanderings of the Baloches before they settled in the countries they now inhabit, distinguishes the tribes entitled to rank as Rinds from those not so entitled, and concludes with a catalogue of their leaders.]

Shukr Alláh hamdá guzárá
badsháh mulka wathen
Thí jihán khák o gilo bí
Heku nindo wash-dilá.
Má aulád Mír Hamzáigh-ún
Sob dargáhá gur en
Azh Halabá phádh kháyán
go jazízán jheroen
Masará Míren Jalál Hán
chhil-o-chyár bolak en
Kalabalá Bompúr ma-nyánwán
shahr Shistán mizile
Khákhtún Hárína bandá
Kech rásten phalawá

Makuráná Hot nindí

Khosagh man Kech-dehá

Azh Halabá Chándiyeghá

Kalamthi e logh pha-guren

Jo mítáf bahr-khanána

Kul sardár Shaihak en

Man Naliyá Noh nindí

Jistkání pha-guren

Phuzh, Míralí, Jatoí

Drust man Seví Dhádará

Dríshak Khán, Mazárí

E go Rindá yagsar en

Azh bunyádá Phuzh Rinde

Sar go Mír en Chákur en

Golo, Gopáng, Dashti

Rind thaliyá dar-ant

Thí Baloch báz bisháren

Drust man Rindá manahá

Nashk-daur pha Gorgezán

E man Thaliyá dehá

Noh koráí áwáren

E go Rindá yagsaren

Rindán man Shorán nindí

Láshar man Gandávagh en

E maní perá o rand en

E Balocha daptar en

Má deún sí sál jangá

E Balocha shiddat en

Shaihak o Sháhdád dání

Las sardár Chákar en

Chhil hazár khái Mír gwánkhá

Thewa*ghán* dáde-potar en

Hol-posh dast-kaláyá

Druh khawán o jábah en

Path pechá go khawá

Phádh lálen mozhagh en

Kárch kátar nughraená

Dast mundri thangaven

Bakar o Gwaharám Rámena

Zar-zuwál Nodh bandagh en

Phuzhán Járo jaur-jawáv en Hadden Díne brádhar en

Pheroz o Bijar Rehán Mírán Rindán zahm-jan en Sohbá, Míbán, Alf, Jám, Sahák o Alan en Haivtán Bívaragh man Rindán Mír Hassan go Brahim en Sháir ki sherán jorí Mír Jalál Hán surphadh en.

Translation.

Thanks and praise to God; himself he is Lord of the land. When the rest of the word becomes dust and clay, alone He remains with serene

We are the offspring of Mir Hamza; victory is in the worship of From Halab do we arise, there are fights with the unbelievers. Foremost is Mír Jalál Khán, there are four and forty tribes. By stages (we march) from Kalabalá (Karbalá?) to Bompúr and the cities of Sístán. We came to Hárún's band, on the right side of Kech. The Hots settle in Makrán, the Khosas in the land of Kech. From Halab come the Chandyas, near the home of the Kalamthis. Dividing out running water and dry land, the chief of all is Shaihak.

In Nalí the Nohs settle, close to the Jistkánís. The Phuzhes. Míralís and Jatois, all in Sevi and Phádar. The Drishaks, Kháns and Mazáris are one with the Rinds. In origin the Phuzhes are Rinds, they were with Mir Chakar. The Golos, Gopangs and Dashtis are outside the Rind circle (dish). The other very numerous Baloches are all included in the Rinds. Distinguished for wealth among the Gorgezes are those in the country of Thali. The Nohs and Korais are mixed together, they are one with the Rinds. The Rinds settle in Shorán, the Lashárís in Gandává. This is our foot-print and track, this is the Baloch record. For thirty years we are engaged in battle, this is the Baloch struggle.

In the time of Shaihak and Sháhdád, Chákar was chief of the whole. Forty thousand come at the Mir's call, all descendants of one ancestor. All with armour upon their forearms, all with bows and quivers; with silk scarves and overcoats, and red boots on their feet; with silver knives and daggers, and golden rings on their hands. There were Bakr and Gwaharám and Ramen, and the gold-scattering Nodhbandagh. Of the Phuzhes was Járo, venemous in reply, and Hadde his brother by religion. Pheroz, Bijar, Rehán, and Míran, the swordsman of the Rinds. There were Sohbá, Míhán, Ali, Jám, Ishák and Alan; Haibat Hán and Bívaragh of the Rinds, and Mír Hassan with Bráhim.

It is the poet that composes the songs, and Mir Jalál Khán comprehends them.

II.

Poems relating to Mir Chakar.

Mír Chákar is the great legendary hero of the Rind Baloches. He is represented as having led them into the countries they now occupy from Makrán, and as having founded a kingdom with its capital Seví (Sibí). He waged war with the Turks under Humáu Chughattá. On the civil war between the Rinds and Lasharis breaking out, the Turks under their leader Zunú joined the Rinds, and the Lashárís were defeated. The Turks seized the Lashárí women, but released them on the expostulation of Chákar, who said that Baloches would be disgraced by being accomplices in such a deed. At one time Chákar was a prisoner to Humáú, who called him up and asked him "What is the best of all weapons?" Chakar replied, "Anything that a man can lay hold of in a fight." The king then had Chákar brought unarmed into a narrow street, and a savage elephant turned loose at the other end. As it rushed upon Chakar, he caught up a dog that was lying in the road, and threw it in the elephant's face with such violence that it turned and fled. Chakar is said to have founded the old fort at Sibi, which he ultimately abandoned at the end of the civil war on his way to the Panjáb. His name has been given to several places in Balochistán, among them Chákar-márí 'Chákar's upper storey,' a hill near Sangsíla in the Bugti country, from which he is said to have taken his last look back at Síbí. This is a physical impossibility, but Chákar was a 'godlike man' (Hudhái mard), and could do things which the present generation is not capable of. Another place, named after him, is Chakar Tankh 'Chakar's defile' in the Marri country.

It is difficult to say how far any part of Chákar's adventures are historical. Baloches began to arrive at Multán and the neighbourhood from Makrán in the time of Hussain Langá, towards the end of the 15th century. (Briggs' Ferishta, Vol. IV, p. 388.) Soon afterwards came one whose name is transliterated by Briggs Meer Jakur Zund, which should probably be Mír Chákar Rind. He obtained a jágír in Uchh from Jám Báyazíd (Ib. p. 396).

This Mír Chákar is said to have come from Solypur, but I have not been able to discover this place. This was about 1520 A. D. About the same time we find Baloches in the Panjáb as far north as Bahrah and Khusháb on the Jehlam. (Erskine's Baber, p. 256.)

This irruption of Baloches into the Panjáb was probably caused by the pressure on them of the Turks or Mughals who were then under the Krghúns invading Kachhí and Sindh. Sháh Beg, son of Zúlmún Beg Krghún, took Síbí first in A. D. 1479 and a second time about A. D. 1511. This occupation may have been the cause of Chákar's emigration. Sháh

Beg made Síbí his capital for some time, and it is probable that he and not Chákar really built the old fort there (Erskine's Baber and Humáyún. Ed. 1854, Vol. I, pp. 342, 347, 348.) There is no record of any collision between Humáyún and the Baloches except during his flight in A. D. 1543, when he seems to have been plundered by them in the Bolán Pass. (Baber and Humáyún, Vol. II. p. 266) and again fell in with them between Kandahár and Sístán (p. 271). This is perhaps sufficient for the introduction of his name into the legends. Zunú, the Turk leader, perhaps stands for Zúlnún Beg in whose name Sháh Beg fought.

The Quarrel of Mir Chakar and Gwaharam.

[This poem also seems from its language to be an old one. It describes the causes of the division between the Rinds and Lashárís, the two sections into one of which all true Baloches fall. The Rinds were under Chákar, the Lashárís under Gwaharám. Finally Chákar in disgust emigrated to the Panjáb, and settled at Satghar in the Lahore District, where he died and is said to be buried.]

Kilátí Havív gushí: Sarí Rínd Ghulám Bolak gushí: Chákar Gwaharám Karákután gushí: Gohar báutíyá kharde gál gushí: phílaven sí-sál-jang gushí.

> Yád khanán náme Iláhí man awwal sar-náva*qh*án Haidar o phusht o phanáh sar hazrate ákhir-zamán Bivá lorí go sawáhá zír maní guftáraghán Bar gwara belán dileghá no salátí brádharán. Mangehá Rinda pha Bompur Kech bághe Makurán Mastaren logh Domkí en man Balochi meraván Rind Láshárí áwárá trán bastha pha-wathán 'Biyáeth, shedhá biladún bilún giyáfen ulkahán Jo mítáfá bi-katún bahr-khanún bi pha wathán.

Rájí ráná kadh ma lekún' biyákhthán dan logh githán

Hukmí tonde nakhífán nokh khuthantesh ádimán

Bozh borán báraghená kotwání andará

Saj khane bázen biháná nuh-hazárí markhaván

Biyárún bagán girdaghená azh Naliva khaur dafá

Gwánkh-jatha jodhán bi kádán 'er-khafe azh Chajuá

Khash gálí o palangá ihul suhren kamalán

Bauf morbanden lihefán hingaloen manjaván

Sikh o tásán bijoren Makurání kadahán

Chakurí deh na nindí.
ro wathi díren ámilán.

Phoshitha Rindán wathí dír pha khawáh o shaddaván

Phádh lálen mozhaghán Rind kásathant pha Deraván

Phádar o Sevi gwáftha Dan Jhal o Nílahá dafá.

Dan Jhal o Nílahá dafá, Hab, Phab, Moh, Malí

dan Nalí khaur dafá

Gáj shahra basthaghená Dan Marágaho dehá

Sangar o khoh Sulemá

Gwafthaghen sher-naran

Sáng Mundáhí dhaníyá

Pan pá bi Methirá Bághchaen Kácho Símá

Dan Dharí o Bhanará

Nangare Bijár theghá Jám Sulemána lurá.

Gohar háutí ki ákhtha gwar Nawáve Chákurá

'Mál maní othíya bag en hande phe-dáre manán' Chákurá dír-zánaghená gwash bi durren Gobará 'Barav o Során joá Kachrákí phalavá, He-miuná bagá bicháren, nind be-anden shafá.' Rosh azh Gwaharám shahrá rafthaghant kharde charián Báraghen borán zawárant pha shikár o sailahán. Hir khushthant juftaqhiyá phar wathi láf-serihán Ráj bundáthant hazárí azh du-demí ziánehá Kahravá thekán khawáthant pha badhen kirdáraghán 'Shin-gurá Gwaharám the*gh*á 'shán-gurá Mír Chákurá Philaven si sál jang ath Gohara hir phadhá Sar galoi báithaghantí nesh rikkthant azh dafá Márá dí ekhawá dí ishtha pha Hudháí ásurá Gudá Sultáne Balochá sahl khu*th*a bi pha wa*th*án Chákur azh bráthí gasúrá. Gwastha Satten Gharán.

Translation.

Kilátí son of Habíb says: to the lofty Ghulám Bolak Rinds he says: about the quarrel between Chákar and Gwaharám he says: of the refuge-taking of Gohar in few words he says: of full thirty years war he says, as follows:

First I remember the name of God, my morning-star of old; lord, and support and protector to the most illustrious prophet.

Come minstrel at early morn, learn my sayings and carry them to the friends of my heart, and the assembly of my brethren.

The bold Rinds came to Bompur, to Kech and fertile Makrán, the greatest family was the Domkí in the Baloch assemblies.

The Rinds and Lashárís met together, they took counsel among

themselves. "Come, let us march hence, let us leave these widespread lands. Let us conquer streams and dry lands, and deal them out among ourselves. Let us take no count of rule or ruler."

They came to their own homes. The chiefs (turban-wearers) ordered their slaves to saddle their young mares. "Loose the slender chestnut (mares) from their stalls, saddle the numerous fillies, steeds worth nine-thousand each. Let us bring in herds of camels from round about, from the mouth of the torrent of Nalí." The men called to the women "Come down from Chajú, take out your wrappings and beds, carpets and red blankets, pillows, and spotted rugs, and many-coloured bedsteads, moulded cups in abundance, and Makrání drinking vessels. Chákar will not stay in this country, he will go to his own far land."

The Rinds clothed their bodies in overcoats and turbans, with red boots on their feet. The Rinds were distinguished for hospitality.

They called together Dhádar and Seví, in Jhal and the mouth of the Nílah; Hab, Phab, Moh and Malí in the mouth of the Nalí torrent. They stayed at the city of Gáj in the land of Marágah. The tigers of men assembled Sangar and the Sulaiman mountains, the rulers of Sáng and Mundáhí became payers of tribute to our chief.

In the boundaries of fertile Kachhí, in Dharí and Bhanar. There was generous Bíjar with his scimitar, and the leader Sulaimán with his sword.

Gohar came for refuge with the Nawab Chakar, saying "Show me a place for my cattle, and herds of camels." The far-seeing Chakar said to the fair Gohar "Go to the streams of Shorau in the direction of Kachrak. There stay at ease with your herds of camels, and have no anxiety by night."

One day some madmen went forth from Gwaharam's city, they were mounted on fine chestnut (mares), for the sake of hunting and exercise.

They killed a pair of young camels (of Gohar's), to fill their bellies withal.

The chief fell into a great rage (lit. rage of a thousand), on both sides damage was done. A curse falls upon the wicked, upon the doers of evil. On this side was Gwaharám with his sword, on that side Mír Chákar. For full thirty years war continued about these young camels of Gohar's. All the excellent youths have been slain, the teeth have dropped from their mouths, and God's mercy has spared us only. Then the Baloch rulers made peace among themselves, and Chákar on account of this feud among brethren passed away to Satghar.

Chákar's denunciation of his foes on leaving Síbí.

Chákar Shaihak gushí: sarí Rind Bádsháh gushí: án rosh ki Seví khili kharde gál gushí: Gwaharámár phasave dáth gushí.

> Bilán mar-lawáshen Seví Gauren sadhaní margáví Jáme Nindavá bhattivá Sai-roshán Baharám neghá Sí-sál uvt o uzhmárá Ján-jebhaván jangiyá Thegh azh balgavá honená Chotán cho kamándí boghán Jukhtán na nashant lárená Warnáyán du-mandílená. Lad ma deraván na rusthaut Misk ma barútán na mushthant Whard dumbaghan meshani Karwálí sharáb sharr joshant Sháhán pha nishán yakhe nest Drustán wárthaghán hindíván Shartán dáthaghán shímenán Bachaki lawar bánzíyá Gwaharám muzhen Gandávagh Singhe ma zirih phirentha Máchíva lawáshtha lanjaíth Alí o Walí druh-dárán Yákí kiláta berones Hágh kávalí Turkánán Rind báraghen boránán Gwaharám azh dude hande bí Ne Gor bí ne Gandávagh.

Translation.

Chákar son of Shaihak says: the exalted Ruler of the Rinds says: on the day he leaves Síbí these few words he says: in reply to Gwaharam he says (as follows):

I will leave man-devouring Seví, curses on my infidel foes! For three days shall the Jám Nindo from his oven (distribute bread) in honour of Bahrám (slain). For thirty years, for ever shall there be war with these gigantic men, nor shall my sword be clean from stains of blood. I will bend it like jointed sugarcane, so that through crookedness it will not go into the sheath.

The distinguished (lit. two-turbaned) youths do not rise up to sport among the houses, they rub no scent on their moustaches, but they eat fat-tailed sheep and boil strong liquor in their stills. There is not one of them with signs of a ruler about him. They have eaten all their weapons, they have gambled away their heads, they have children's sticks in their hands. Let Gwaharám stay in dusty Gandáva, a stone thrown into a well. Máchí has drunk blood; Alí and Walí are traitors. The rebels' fort has been surrounded, and reduced to earth by the tyrannous Turks and the Rinds on highered mares (chestnuts). Gwaharám (will be expelled) from both places, (and possess) neither a grave nor Gandáva.

III.

Dosten and Shiren.

The legend on which the following poem is based is as follows:

During the war between Mir Chakar the Rind leader and Human Chughattá king of the Turks (i. e. the Bádsháh Humáyún), Chákar was forced to consent to give up some Rind maidens to Humáu, but actually sent instead young men in disguise. On this being discovered, they were ordered to be kept in perpetual imprisonment in the fort of Harrand. Among these prisoners was Dosten. He had been engaged to marry his cousin Shiren, who remained faithful to him during his many years' imprisonment. At last her parents said that she must no longer remain unmarried, no hope being left of Dosten's return; so they found for her another husband, also named Dosten. (This is alluded to in line 98, where she says 'Not this Dosten, but the old one.') Him she long refused to marry, but at last yielded to the pressure put on her, and arrangements were made for the ceremony. Meanwhile Dosten in prison at Harrand had succeeded in gaining the favour of the Mughal or Turk Governor of the fort, and some liberty was allowed him. His mare had died, but had first borne a fine colt which had grown up, and which Dosten was allowed to keep. One day games and races were going on, and Dosten asked and obtained leave to join in the race. Mounting his horse, he said good-bye to the Governor, turned its head towards the Chachar Pass and went off at full speed. Several pursuers followed him, but no horse had the endurance of his chestnut. At intervals along the rocky pass they stumbled and fell, and these spots bear the horses' names to the present day. At last he was left alone, having wearied out all his pursuers, and travelled homewards On nearing his tribe, he overtook a minstrel (Dom or lori). He asked him the news, and where he was going. The minstrel told him of the impending marriage of Shíren, and said that he was on his way to sing at the wedding. Dosten then told his story and prevailed on the minstrel to change clothes with him. Thus disguised, he made his way into the assembly with the other minstrels, and sang the poem which follows, bringing in the substance of a message he had received in captivity from Shíren. He was immediately recognized by Shíren, who declared that she would marry him and no other, and they were happily married then and there.

In the poem Dosten first begins by saying how his mare could not live in the heat of the plains, and then passes on to say how a Khorásán merchant brought him down Shíren's message, which constitutes the remainder of the poem. It begins with an animated description of a Nomadic Baloch tribe in the hills moving to fresh pastures after rain, and then turns to Shíren weeping in her little hut for her lost lover. Her companions try to console her, but she will not be consoled, since he is in captivity. She then describes how when she wanders over the hills with the other Baloch women, according to their custom, she always picks a flower for her lover's sake, and ends with a prayer for his safe return home again.

Lines 40-44 seem to be an interpolation. They have no connexion with the subject matter of the poem.

Zangí maní badero Gwaharám maní jám o bel Whántkár Shíhane Sháhiye Saughan pha thaí risháná

- 5 Nokhi-ákhthaghen masáná Sighen gor-khushen syáhárá Afa na wárth Báh neghá Kikh o Karjalán Sindeghán Lotí báhirán Dashteghán
- 10 Loţi wadh-maháren jidhán Phitokh dafá mádh-gorán Pori phur kumáren áfá Suti phuri khaiáván Whává kálrá nelán
- 15 Márwárí jawán zivirenán Marde azh Hurásán ákhtha Leghár chádar o humboen Bár rodhanání gonath Hurjín maidhen bhangání
- 20 Sarbár Kandahárí miskant Phaighám gon-athí Rindání

Tahkíken shalám Shírene. Nodhán shanz-jatha Konárá Dasht-o-dámana Mungáchar

- 25 Sanniya nughor humboen
 Dor phurant-i amrezán
 Larzant cho gwanání thákhán
 Chotant cho kawándí boghán.
 Ladí mánchatha máldárán
- 30 Meshi buzi whántkárán Mezhdár Sahák Yárán Bumbár basthaghan bánukhán Sarbár lárithan gwánechán Bháwanar khandagh o Nágáhú
- 85 Khondán phrushthaghan zardoán Lokán phashaví katárán Kádán go himáren phádhán Shírená jatha srádhen kul Ma Narmukh geáven rejá.
- 40 Mesh azh draniná ser khan Buz azh gwárighá lál phulá Rind azh maidhen gandímá Pahnwál azh phanír ponchá Lahri azh gwan phothákhá
- 45 Gwán' janth dilsaren dáiyá Zirí kadahe meteí Ro da shakhalen nokháfá Malgor shusthaghen mahlíjá Randíth mushi malgorán
- 50 Khaithí da wathí chyár-kulá Kullá darríya bandí Shiskant thaghard nichthent í Jhul phalavá letení Dast janth avr barziyá
- 55 Khashi nughraen ádená
 Era Kamálú sar záná
 Gindí droshamá heriyá
 Gregh khant humáren chhamá
 Anzí ríshant pha dramá
- 60 Jígh sar katiká mená Much ban janán jedí gobár Sharren somaren chhil-o-chyár Biáyant o gwara er-nindant Shár phalavá letená

- 65 Phursant-í dila o hálá.

 'Pharche khunalat khordema
 Suhren man makh o níláná
 Bríkh thaí bambaven danzená'
 Gregh bíth, janán telánk dáth
- 70 'Dír bíth, o janán, jawán e ná Dir bíth, o janán, dír ninde Bilán khunal o khor-demá Suhrán man makh o nílá bant Bríkh o bambaven danzen bant
- 75 Dost shume phakár nen Knmar ki jána dozwáhá Suhrá reá darkárá Dítha harraghen bad-duáyán Turkán azh hareb gwázentha
- 80 Ma zar-joshen Arandá shahrá Sunjen isp-tah'alen láfá.' Dúng bant janikh Rindání Malání phadhá shef ban. Kháyant khargazí krámáná
- 85 Nekhen-niyaten gwandáná. Maurán azh kurmán sindáná Phatán gwáraghí lálphulán Nem jamaven jígha jant Nem khunal o sar-hoshán
- 90 Nem pha sammáen khauliyá Yakhe pha maní níyatá Chitho ma wathí musht khan' Ba phusht azh badhán jaurená 'Shíth daz-gohár jediyá
- 95 Dastán pha Hudhá burzáre 'Alláh ki biyár Malik Dostená Sauten sammáen khauliyá Eshiyá ná, hawán oliyá Bor pha lammaghán sheriyán
- 100 Baro mizilán dírená Biyár wázhá amírená Nind-o-nyádh phith-o-máthání Dímá shakhalen bráthání Rozí bá Malik Dostená 105 Dídár khasha rozí bá.

Translation.

Zangí is my chief, Gwaharám my leader and friend, the owner of excellent mares. I swear by your beard, by the new grown hair of your face. My mare, hunter of wild asses, is sad, she will not drink water by the Indus, nor eat the reeds and karjal grass of Sind. She longs for the herds of wild asses of the Dasht, she longs for her own pleasant pastures, for the female wild asses of the Phitokh Pass, and the pools full of fresh water; the sandflies and musquitos irritate her, the vermin will not let her sleep, the Márwárí barley is coarse to her.

A man came from Khorásán, his clothes and face dirty; he brought with him loads of madder, saddle-bags of fine bhang, and bales of Kandahár musk.

He had with him a message from the Rinds, a true greeting from Shiren.

The clouds have rained on Konár, on the plain and hill-skirts of Mungáchar, on the pleasant slopes of Sanuí.

The pools are filled to over-flowing, (the water) trembles like the leaves of the gwan-tree (*Pistacia khinjuk*), and bends like joints of sugarcane. The graziers have given the word to march, the owners of the sheep and goats, Mezhdár, Sahák and Yár Khán; the housewives have tied up their bundles, the camel-drivers have loaded their bales. On the hill-passes of Bháwnar and Nágáhú, the yellow camels bend their knees, the male camels in long strings, the women with tender feet. Shíren has pitched her fair tent on the wide spreading land of Narmukh.

Feed the sheep on dranin-grass, the goats on red-flowered gwarigh, the Rinds on wheaten flour, the shepherds on curds, and the Lahris on gwanberries.

She calls her beloved nurse and takes up an earthen cup, she goes to the sweet, fresh water, and her handmaiden washes her hair. She combs and smooths her hair and comes to her four-sided hut. She closes the door of the hut. They plait and spread the matting, and she reclines on the carpet.

She puts her hand into her bag and takes out a silver mirror, rests it on her shapely thigh and looks at her houri-like countenance. She weeps with her tender eyes, tears drop upon her cheeks and on her variegated breast-garment. Her companions and sisters assemble, fair comrades forty and four; they come and sit down by her, they recline upon blankets, they ask after her heart and condition.

They say, "Why are your face and earrings uncleaned, your red and blue clothes unwashed, your locks unkempt and dusty?" Weeping, she pushes the women away and says, "Away from here, women, you are not

good. Away! sit far off! Let my face and earrings be uncleaned, my red and blue clothes unwashed, my locks tangled and dusty; I do not want you for friends. He who was the friend of my heart, for whose sake I should adorn myself, I saw carried off from his native land by evil cursed Turks, shut up in the wealthy city of Harraud, within an empty stable.

The daughters of the Rinds form a band, (and wander) following in the track of the showers. The vultures come croaking, invoking good fortune. Breaking the Maur-flowers from their stems, and plucking the red gwaragh flowers, some place them in their boddices and breasts, some in their earrings, lower and upper, and some (keep them) for their true love's sake. Pluck one for my good luck, and keep it in your closed hand; and, secretly from my bitter foes, my own sister and love says, with hands raised up to God. "May God bring back Malik Dosten, according to his true promise, not this one, but the old one. Swiftly, tiger-like chestnut mare, bear him southwards, come by long stages, hring home my noble lord to dwell with his father and mother and the assembly of his beloved brethren. May Malik Dosten appear, may he appear to my sight.

NOTES ON THE TEXT.

The text of this poem is taken from two versions, one recited by a Shambani, the other by a Marri. There are some variations which are noted below, the Shambani version being marked (a), the Marri version (b). The Shambani version is the base of the text. A fragment marked (c) from a Gurchani Dom supplies a line or two.

Lines 10 and 15 are supplied from (c).

Line 11 is only found in (b) and (c).

Line 18. For rodkanání (b) reads mehlavání 'spices.'

Line 27. Larzant is from (b). (a) reads drafshant.

Line 32. For bánukhán (b) reads godiyán, with the same meaning.

Lines 40—44 appear to be interpolated. They only occur in (a), which contains several passages not in the other version.

Lines 46-48 are from (b). The whole passage from line 45 to line 57 is almost identical with one in the poem of Laili and Majnún. Lines 56 and 57 are from (b).

(a) reads: 'Phullen zán sará er-khant Gindí azh wath o gonáfá

Line 62 is from (b). (a) reads 'Hirth jediri chhil o chyar'

Line 68. For danzená (b) reads be-zaunk-an, 'unornamented.'

Line 69. For gregh bith 'weeps' (b) reads zahr girth 'is angry.

Line 75 is from (b).

Line 77 (b) reads 'Suhrání riár rakhí.'

Line 79 from (b) (a) reads:

Turkán mughalán giptha.

Between lines 72 and 80 (b) inserts

Ganjen ispahán phár bítha

the meaning of which is not clear. Also after 1. 81 (b) inserts,

Bakhta mír janeghá khushtha

Dost o ispahána bokhtha,

which is equally unintelligible.

Line 99. For pha 'towards' (b) reads phalav 'direction.'

Line 100. From (b) (a) reads:

Khosárá dehán dírená

'Swiftly to his distant country.'

IV.

The Rise of the War between the Rinds and Lasharis.

[This poem is another fragment of the Chákar cycle, giving an account of the spoiling of Gohar's camels by the Lashárís, and Chákars' vow of revenge. The episode of the refugee-lizard is quoted by one of the characters as an illustration of the extreme Baloch doctrine of hospitality. Rehan and Járo the Rind warriors mentioned were sister's sons to Chákar. Dodá who is mentioned at the end is Dodá Gorgez, celebrated for the revenge he took for the spoiling of Sammí's cattle.]

Nodh Bahrám gushí: jaren Rashkání Baloch gushí: imar Bulmat Kalmat karákután gushi: bághár báutián gushí.

Whazh-gushen Lorí biyár wathi shághár Má sará charen bairame phághár Jawán mard dátárá gire dádhá Zí azh Sanniá giyáfená Laditha durren Gohará shodhá Khthaghá báuti gwara Mírá Chákurá shírá zí gawar-zírá Gohará durrená hawar dátha "Bagavo Mílahá avan dánen Go má Láshárí jherave mánen" Gohará lade sar-jamagh dáshtha Dastá Gohar man Kacharak nyástha

Rapthaghant Shoráná phare sailá Chakurá Mírí bandane shahrá. " Má tháshún dan baghchaen Gájá Gohar dáchí ma beghaván danzent Máighá shír dan náfaghán shanzant" Chákurá phurs' azh Malaven jatá, "Zith khan jat, de manán hálá, Cho khutha khai go Gohara málá?" Cho jawáb dátha Melaven jatá, "Akhthaghá Láshárí hame chindrí Khushthaghá hir cho khenaghá mardí Chham jatha durrgoshen Maheriyá 'Jat, hame gálá bile sherívá Phuturen Rind ma deraván druáh ant Dáchí pha hirán hardame záhant' " Badh burtha Reháná Nawávená Phuzh Járavá jaur-jawávená " Má phara durren Gohará hirán Havbará shámálo janún shirán Shart khanún haisí chotavá birán" Bágar Jatoi jawáb dátha " Ba-khú-án durren Gohara Sammí Hota pha báután niyath khamí. Shah Hussain cheravá roshá Bibarí pheshá nishtha ma loqhá. Dar-shutha bághár azha gedá Choraván ilgá bokhtha pha dínía (or pha randá) Gur-khanána dan medhira loghá; Demá dar-khaptha mardume jawánen Sharr kalánch ant cho dushthaghen shírá Dholant oshishe karáiyán. Kiámahá minnate khutha-í bázen 'Choraván, bághár bil, maní shámen I-katar márá phar wathí námen' Na-jánen joraejaven jatán Kálihán bághár khushtha pha latán Odh niya' loghá Sammaven sálo Dast kauliyá phijatha dánhí ' Agh phara bághárá na-ro bái Man thai bhen, tho mani bhái' Hot mirání dará ákhtha Súrihá pha demá jawáb dátha

No Amul-máin, no Amul-máin! Yarbare bosht, gal mayá goná. Man phara bághára khanán choná An dighár shahmí bith azh honá Shingurá shast shángurá phanjáh Drust pha bághára bíthaghá yag-jáh Omará nashke ishtha pha kaulá Hon gire Bálácha phara honá Súrih Dodá phara gokhán.

Translation.

Nodh son of Bahrám sings: to the fierce Rashkání Baloches he sings: of the war between the Bulmats and Kalmats, of the lizard becoming a refugee he sings.

Sweet singing minstrel bring your guitar, bind a large pagri on your head, let the good man receive gifts from the generous.

Yesterday thence out of fertile Sanní, marched the fair Gohar: she came for shelter to the Mír, to Chákar ever-victorious with the sword. Then spake fair Gohar "The Lashárís are set on quarrelling with me, they let not my camels remains in the Mílah pass."

He collected all Gohar's camp and goods and placed her in the valley of Kacharak. Then they (i. e. the Lashárís) came wandering to Shorán; to a town under Mír Chákar's rule (saying), "We will gallop (our mares) to grove-encircled Gáj; let Gohar's female camels mourn for their young in the evening; let the milk from their (unmilked) udders drip down to their navels.

Chákar asked Mela the camel-herd, "Quick, camel-herd give me tidings. Who dealt thus with Gohar's cattle?" The camel-herd Mela thus replied: "The Lashárís came down here in wrath, they slew the young camels as if with the anger of men. Gohar the fair camel owner hinted to me to be silent about it, saying, 'Herdsman, keep this matter quiet, let the true Rinds remain in peace, the female camels daily bear more young ones.'"

Then Rehan the Nawáb became angry, and Járo the Phuzh bitter in reply. "In exchange for fair Gohar's young camels we will take a seven-fold revenge with our swords, we will gamble with heads and hair and turbans." And Bágar Jatoí answered and said, "Where are the fair Gobar and Sammi (her sister)? When was a hero wanting to his refugees? As in Sháh Hussain's day of trouble, Bíbarí sat in front of her house.

A lizard dropped out of a dwarf-palm, and the boys pursued it, chaing it into the chief's house. Then the good woman came out in front to meet

them, wearing beautiful ivory bracelets, white as fresh drawn milk, slipped on over her soft arms. She entreated and implored them saying, 'Boys, leave the lizard alone, it is my refugee. Do so much for me, for your own honour's sake.'

The boys, ignorant and boorish camel-herds, killed the lizard with sticks. Her husband and lord was not there. She sent a complaint to him by letter, saying, 'If you do not go and fight on account of this lizard I am your sister and you are my brother!' Hot returned to his home, and the hero thus answered back 'Hear Amul-máin! hear Amul-máin;' stay where you are, do not speak.

I will act in such a way about this lizard that the ground will be filled with blood, and corpses lying sixty on one side and fifty on the other, all collected into one place for the lizard's sake, as when Omar was released on his own promise, as when Bálách took his revenge for blood, or the hero Doda for the cattle.

V.

The Competition between the Poets Sobhá and Gáhí.

Part I. Sobha addresses Gáhí on the question of the Laghárí refugees with Jawának, and taunts his tribe on their modern origin.

[These four poems constitute a complete specimen of a kind of exercise not uncommon among Baloch poets. Sobha a Khosa and Gáhí a Laghárí draw comparisons between their tribes and chiefs, challenging each other's claim to have come in with the original settlers under Mír Chákar, and taunting each other with failing in the exercise of the cardinal Baloch virtue, hospitality to refugees. Relán the Dom minstrel is commission by each poet to learn the words of his song, and to carry it back, and recite it in the assembly of the hostile tribe. The Laghárís and Khosas are old enemies, and their hostility still smoulders after thirty years of British rule.]

Sobha Thegh Alí gushí: Jarwáren Baloch, gushí: Khosagh Kaloí karákutá gushí: Laghárí báutiyán kharde gál gushí:

Whazh-gushen Reláná shádhihání shághá bare Maín salámá bi sháiren Gáhiyá diye Nishtho droghání zawáná wash khane, Ewakhí será go manán chachhon tule? Bhúcharí Dálán kilát nám gire Nuh-manen báránrá wathár kans diye Jawának urdání raghazá roshe khafe

Ahin shar háthí raghasá chít árthaghe Sher chápulá azh Kharrá thalá guze Go manán hair bí, zamíná jáhí lahe Phesh gudá main sailavání depánthave Agh thará wahm bí zamíná jáiz khane Dav-charen zahmání ná-washen jáhá rase 'Shingura 'shángur lashkarán dem-o-dem khuthe Zahranen mardán nodh-dilá seráfá jathe. Jawának urdání tawáren goshán khafí Har-chyár demá ghoravání dáto rudhí Cho thaí bachhání dafání gonáf hushí Nodhí berána beghavá biyáyan thánahí. Biyá, O Lashárí, azh gwareyá dar-khapthaghe? Gude Zunuwá ghoravá roshá gár athe Sailaí Míren Chákurá phauzhán ruthaghe Rind nar-borán azh zamíná resinthaghe Khushthaghá Rámen damámo charenthaghe. Dai manán nashkán tho kithán rosh khard bithaghe, Bakar O Rámení kithán ladá gon athe? Ghoravo urdán phelatho Turkání rukh ath Doshí ma Jhalá Turk ghoráyán grandaghá An demá Gandávagh Hudhá main dem bíthaghá Turkán shád kámá Rind 'shamedhá zahr gipthaghant Hon azh chamání chimáká dar-khapthaghant Gwashtha Nayániyá ' Main hudhábund go-khapthaghant.' Lajavo, Shorání dhaníyán grán bithaghant Bijar, Phuzh, Chákar Shahdhár ákhthaghant Allan o Miskání Sahák Mádán athant Bagavo lajjání sará katár dáthaghant Asp go sonáen zarívá bashkáthaghant Rind azh nokh-zenen biháná er-khapthaghant Piyádhaghá Rind azh takht Shoráná ákhthaghant Thorave Rindára olí Láshárí war adh Mir go Phulá azh Kawará drikhenthaghant. Whazh-ghushen Relán shádhihání shághár bizír Mard pha báután choshaut, sardáre maní Gáhwar o Hánen Sáhibáná jag-sahí Gwar Nawáv Hán kúk burtha bázen barí Gorisháníyá sángat o Káhan Marrí Burzá go Summenzáiyá brádkargarí Akhtha gwar Hánen Jawánaká báután thai 'Khosaghán, ki man neyán Laghárí khadhí' Go má chyár sálá nishthaghá báutí sharíkh

Bandave khohen nashkato hapt phushti guzi Mánik loghá har-khase omedhá duráh Mánik kato bihisht jo sará Gudí sammá, kotái pahráe phadhá Do Balochání ákhthaghant wákyái sará Do shafán bitha gwar thei khánen Methirá. Chham anzíván rapthaghant gríbána phadhá Dobahá dáthen markhave, paidáish khuthen Lajjí bánukhán phar wathí sháná bashkathen Doda thei námúz man jiháná mashhar athen Gudá dráhíve basthaí go Hánen Shakalá Túmí gwádhentha wa ganjen Bakará Jawának phauzhání sara Gájí barbará Sháh márívá gonekhá go sheren Haidará Ní ki ákhtha dan Sirí Mitháwaná Nivámohí Zíhár maín sharíkhán har do sará Jahl-burziyá hek-byá resintha jarán Deúní rebá er-khafí jáhíyá buná Sher ki gwámesh phrushí lorhivá dará Bánz ki símurgh jhatíth maidáná sará Hánen Arziyá gwánkh be ambráyá jathá Khosaqhá nál bastha galaqhá kurká khuthá Laj whántkárán phíl-athí símurghíá burtha Ispar o savzen nezaghán Bashkyá sáh khutha Hánen Dilshád mardiyá berá tharatha Shái phitha ashk en ki shawar paida khutha Har do urdání nyámaghá sámí suhr khutha Dodá Hánen Jawánakár zíthen hair khutha.

Translation.

Sobha son of Thegh Alí sings: to the Jarwár Baloches he sings: of the fight between the Khosas and Kalois he sings: of the Laghárí refugees he sings, as follows:

Sweet singing Relán take away your guitar from the assembly, give my salutation to the poet Gáhí (saying), Sit down and make clean your tongue from falsehoods. How can you weigh single seers against maunds. You mention the forts of Bhúcharí and Dálán, you are placing nine-maund weights upon yourself. In the face of Jawának's armies you will fall in a day, beneath that elephant's foot you will be crushed, beneath its blow you will pass away from the valley of Kharr. Make peace with me that your land and place may remain to you before you are again terrified by

my sword. If you are anxious, then legalize (the possession of) your land, for when swords are biting you will be in an unpleasant place, when on this side and on that armies stand face to face, and angry men are satisfying their swords' hearts (with slaughter).

When the shout of Jawanak's hosts falls upon your ears, and the dust of the horsemen rises on every side, so that the moisture of your sons' mouths dries up, and the cloud-like (mares) come gallopping (loose) to their stables in the evening.

Come O Lashárí, where did you originate from? You were missing on the day of Zunú's horsemen; did you reap (a harvest) of Mír Chákar's army? did you chase the Rind chargers (lit. male chestnuts) from the land? When Rámen was killed you played the drum. Give me your tokens (to show) when you became separate from us. Did you march away with Bakar or with Rámen? Did you accompany the horsemen or the army to meet the Turks? That night when the Turkish cavalry thundered in Jhal, or towards Gandáva when God was on our side, when the Turks rejoiced and the Rinds became angry; blood issued from their eyelids, and the women said "our lords have met them."

The rulers of Shorán became heavy with shame; Bijar, Phush, Chákar and Shahdhár arrived there, Allan and Sahák Miskání were there; they gave a string of camels to ransom the shame-faced ones (i. c., the women taken by the Turks), horses they gave and bright gold, the Rinds alighted from their newly-saddled fillies, and on foot (having given up their horses) the Rinds returned from the throne of Shorán. Formerly the Lashárís also showed kindness to the Rinds, when they let Mír (Chákar) gallop away from Kawar on Phul (the name of a mare belonging to Nodhbandagh).

Sweet-singing Relán, take up your guitar of merry-makings, (and declare) what sort of man my chief is towards refugees. Gáhwar and the Chief Sáhib Khán are the most trustworthy of men; many times did they complain to the Nawáb, that the Gurchanis had made a union with the Káhan Marrís, and a brotherhood with the upper Summenzais. Your refugees came to our chief Jawának, saying, "we are Khosas, we are no longer Leghárís." Four years did they stay with us, sharing in our protection.

The marks of their dwelling on the hills shall remain till seven generations pass. In Mánik's house every one lived in great hope; (for this) Mánik (shall have) a dwelling on the streams of Paradise.

(To your chief), in his latter age after the stage of deceit (in his second childhood?) came two Baloch women seeking for refuge; two nights they stayed with your mighty lord. Tears fell from their eyes and they cried aloud. He gave them the mares for twice their value, he made a profit of it, to his own shame he gave them to the shame-faced women.

Doda your chief became celebrated in the world! Then he made an agreement with Shakal Khán, and made them pass on to Túmí and wealthy Bakar.

The helper of Jawának's armies is the Pír Gájí Barbar. The saint accompanies us, riding on a swift camel, with the lion-like Ali. Now that we are come into the Sirí and Mitháwan (names of torrents on the Deráját frontier). Zíhár is the arbitrator between the parties on both sides. Up and down did the two bulls pursue each other (hek-byá a Punjábí phrase). Let us deceive them that they may descend to a lower place. Just as a tiger strikes down a buffalo outside its hedge, or as a Símurgh strikes a hawk on the plain, so did the Khán call Arzí and his companions. The Khosas shod their horses, the troop made a rattling. Your chiefs were ashamed, as when the Símurgh carries off an elephant. With shields and grey spears Bashkyá made a shade. Dilshád Khán heroically encompassed them about, honour to the father who bore you! Between the two armies they made their graves red. Dodá then quickly made peace with Jawának Khán.

Part II.— Gahi replies, praising bravery and taunting Sobha with being a coward, and not a true Rind.

Gábí Gorish gushí: Kaloí gushí: Sobhár phasave dúth gushí.

Whazh-gushen Relán shádhibání shághá bivár Kaunsh bángavá gwar maní báládhá bidár Chambare sak jan, malgí dílá gham guzár Jangí katárá dil machande: jawánán bisár Nishthaghe satá whash nish námúdh-tawár Azh waliyání khashthaghe rand o kissawán Hair phadhá: ráj-hán rosh ant, jang syáhen shaf ant, Jang phadhá mard o markhaván jawain rosh nayant Gáhwaren hindí bingaven hotán charant Dhauraven kotání sawádá zel khanant Chandeán warná pha dafá gozán janant Jangavo ninja bí, phadhá pahnádh girant Bingaven hotání raghámá ambráh navant Azh phadhá gudá nishtho amsodh warant Go doen dastán sar o záná janant Jangání dahká har-chyár khundán phirant Gwadilen mar go gindaghá goriyá trahant Ashikání káren medháná ravant

Taukal berivá dilár telánká diant Malgí dílá pha zirih o zirih-phosh khanant Kadahán zahrená sharábí nosh-khanant Ma saghárání thafthaghen ihorán khafant Gáhwaren theghá phar wathi námúdh janant Go wathi khánen Methirá miskí zar ant. ----. Whazh-gushen Relán shádhihání shághá bare Maín salámá bi sháiren Sobhár dive Methira randá zír ki Bompurá khai e Man dilá zán ki tho Khosaghá máthí bráth naye Sov labán nyámaghi dárán sushe Armáná! zánant azh sadhen sálán gwasthaghe Hai gannokh e hai zha thána kisthaghe Bakar o Rámení shaqhána mára jane Tho khithán roshí Rind Lashárí bíthaghe. Ki man daryáyání lahravo chalán gár-athe Beghavá míren Chákurá chaukídár athe Má wathí shán cho mastharen Rindán pholatha Ewakhi ser go manán har-ro tolatha Man thaí háthí maghazá shon dián Biyá medháná chambavá símurgh bián janán Arava mardán Sáwano lahri rasthaghe Nokh-nochán phágh phithí mardum basthaghe Mark násenthe, pha chihán roshe shádehá Shán phirenthe, gandaqhen gin dostehá Man dilá zán ki maut thará nelí dánsará Dodáí dáng bíthen man bawren chádhará Medh Máchíya Hamzahá jorí na be Khosaghá Rindá manavo máníva dare Phuturen Rindán cho khutha báut phadhá Gohare hirání sara cho khutha Míren Chákurá Sammíya gokhání phadhá Dodá lurá Khoh sardemá keharen máná lurá Sar wathi dáthai garimen mál sará.

Translation.

Gáhí son of Gorish sings; the Kaloi sings; in reply to Sobhá he sings.

Sweet-singing Relán bring hither the guitar of rejoicings; bring into my life the fresh breeze of the morning; strike powerfully with your fingers, drive out grief from the bright (coloured) body. Do not frighten

the heart with battle-array; praise heroes! Thou hast sat in the assembly with an ever sweet song of praise, and from our forefathers hast drawn forth our tracks and legends.

After greeting: The chief is the day, battle is black night; after a battle for men and horses there is no blessed day. The glittering weapons devour youthful warriors, and make populous forts empty of display. Some youths boast with their mouths, "We will be bold in the fight," but afterwards they turn their backs and are not in the company of the storm-cloud of young heroes. And afterwards they sit and lament and strike their heads and thighs with both hands.

At war's alarm they wander to all the four quarters. Cowardly men flee like wild asses, at mere sight (of a foe). The business of strong men is to go to the battle-field: they give their hearts a push off (from the shore) in the boat of confidence: they clothe their bright bodies in helmets and armour: they drain cups of fiery spirits; with burning white brands they fall upon the crowds, they wield their glittering blades to their own fame; with their own Lord and Chief they become like a sweet odour.

Sweet-singing Relán, take away your guitar of rejoicings; give my greeting to the poet Sobha, and say 'Examine the tracks of our Chiefs, and see who was at Bompur. Know in your heart that you are not whole brother to the Khosas. A venal awarder of victory, you will be burnt with wood. Wretched man! They know that you have past a hundred years, that you are either a fool or have abandoned your home. And in that you cast scorn at me regarding Bakar and Rámen, when was it that you became a Rind or a Lashárí?

For you were lost in the waves of the river's flood, you were Mir Chákar's attendant for your (daily) evening food, while we, like mighty Rinds, sought for glory and every day weighed our single seers against maunds. I will explain things to your elephant's brain. Come into the battle-field, and, becoming a Simurgh, I will strike you down with my talons, as in Sawan (the rains) the torrent sweeps away the men of Aro. You bind on the new and fine pagri of other men; you are gasping in death, when can you have any pleasure? You have cast away honour and made yourself a friend of worthless life; know in your heart that at last death will not spare you. There was disgrace on your head in the matter of Dodá. Medhs and Máchis are not fit companions for Hamzah. You are excluded from home and food with Khosas and Rinds. For how did the true Rinds act with regard to refugees? How did Mír Chákar act with regard to Gohar's young camels; and about Sammi's cattle, how acted Dodá with the sword? when, like a tiger on the mountain tops, sword in hand, he gave up his life to protect the cattle of the poor.

N. B.—Dodá here alluded to is Dodá Gorgez, a legendary here, not the Dodá Kaloi mentioned in the former poem.

III.—Sobha's rejoinder, going over the legendary adventures of the Rinds, and asking what share the Kalois took in them.

Sobhá Thegh Alí gushí: Jarwáren Baloch gushí: Gáhíyá phasave dáth gushí.

Kádir námá har sawáhá yád khanán Sag-satáren bandaghi ardáse manán Relání Lori biyá hadísání durr-gehán Sáz-khane shághá gwash Balochání nugdahán Dáimá nyádhe bíthen go Sultání sarán Rind o Láshárí ma buná bráthán dáimá Má khutha Lashárí Baloch khaptha pha shaghán Mehna e zánki roth Panjgúra dehán Kech Panjgúr kissaván gosh dár ki gushán Má hawán Rind ún, azh Halabá phádh-ákhthaghún Dubarán jangí go jazízá mán-ákhthaghún Dem rosh-ásán saríná er-khapthaghún Hamzaí aulád sobh rasúlá bashkáthagh-ún Hárí malhána ráhí sháh-dagá khapthaghún Ungurí dastá thíbare jangá gipthaghún Pha Karim sáz kuzratán shodhá gwasthaghún Shahr Istámbol go Imámá wath charthaghún Ma Jaghina gwar Shams-din Sháh ákhthaghún Shodhá Hárína pha turá jangi khashthaghún Unguri Kech Makuráná bahr bithaghún Shahr Sistáná o khamáná bahr bithaghún Shedh pha demá má Baloch tálá bíthaghún. Shedh pha demá tho wathi nashkán de manán: Rind mán Kechá; Kech thán demá nishthaghe? Chil o chyár halkán; go khai ladá gon-athe? Ní ki ladána khaurí sarhaddá á*kh*tha*ghún* Las-Belá o Kalmatíyá gíwar-tha*gh*ún Habb Báráná pha muvárik she-bíthaghún Pheshá Núhání azh Nalíyá er-khapthaghant Jistkání ma Gáj siháf ákhthaghant Lak Salári Chándeh azh Káchá khapthghant Rind Lashárí Narmukh rej bukhthaghant

Rinde Dhádará sariná er-khapthaghant Láshár pha Gandávagh saráerá bíthaghant Jalikán Loí tho khithán joán bahr athe? Gind! nawán Gáhí tho radhívá gon khapthaghe Arna Hárín basthaghen baldán gon athe Tho hawán roshe be-mayárí ákhthaghe Sáhib rosh zurthaghen, zarán árthaghe Sherá mán-dátha pha do-handá khard bíthaghe Zindagh o druáhá mán dighárá sar-bithaghe Phurse Gáhíyá, tho chi maskífí zindaghe Wapthaghen mardání tafákhán go man gane? Tho go dah loghá ákhtho báut bíthaghe Hán míriyá pha barátán chárí athe Túpak daste Umar Hán bashkáthaghe Man dilá zán ki tho mazain shán mat nive Tho ráj áhan-e, án thaí sultání sar-ant Gwar maní mírá ákhtho báut bíthaghe Har chyár khundán har hamú Ráján díthaghe Kumbhí gokhání shagháná mára jane Khoh phísh-buren, ambarání sifat khane Gwashthaqhán gálán Gáhí, tho saharál na be Medhirá randá zír pha Bompúrá kháyant Mánika halká hon avo lajján rikhthaghant Dan phadh-o-pheshí chedhaghí nashk oshtáthaghant.

Translation.

Sobha son of Thegh 'Alí sings; to the Jarwar Baloches he sings; in answer to Gahí he sings.

Every morning I remember the Creator's name, my trust is in the service of God.

Come, minstrel Relán with your beautiful legends, play on your guitar, chant the praises of the Baloches. You have ever been a dweller with kings, Rinds and Lashárís from the first have ever been your brethren.

I who called the Lashárís Baloches am scorned by you. Know that the scorn will travel to the country of Panjgúr. Attend, then, while I tell you the stories of Kech and Panjgúr. We are those Rinds who arose from Halab, and twice joined battle with the infidels. Setting our faces to the rising sun, we descended from the west; we are Hamza's offspring, the Prophet gave us victory. Leading our strings of camels, we pursued our way along the highroad. Coming in this direction we fought again, and by the might of the Merciful we passed on thence. At the town of

Istámbol we rode with the Imám himself; In Jagkín we met with Shamsu'd-dín Sháh.

Thence we rapidly drove out Hárín in fight. Hither Kech and Makrán we distributed, we divided the cities of Sistan by khamans (i. c. bows, a bow representing a man's share). Henceforward we Baloches separated. henceforward do you give me information about your track. The Rinds were in Kech: in what part of Kech did you settle? There were fortyfour settlements: with which camp were you? Now when marching on we arrived at the torrent boundary, at Las-Bels and Kalmatí we separated. and we settled in prosperity at Habb and Bárán. First the Nuhánis descended by the Nali pass. The Jutkánis came to the running water of Gái. The Chándehs descended from Kách by the Lak and Silárí passes. The Rinds and Lasharis pitched on the irrigated lands of Narmukh. The Rinds descended from the west to Dhádar, the Lusháris came from above down to Gandáva. In Jálikán and Loi what streams did you share in? Look! Gáhí, perhaps you were with us by mistake. Or perhaps when Hárin was defeated, you were among the captives. You came shamelessly on that day, when, having robbed Sahib of life (lit. day), you carried off his wealth. Having attained the low-lands you separated into two parties, alive and well you lay down (hiding yourselves) on the ground. Ask (and find out), O Gáhí, in what disgrace you are living; will you compare with us the dreams of sleeping men? You came with ten wives (lit. houses) and became a refugee, you posted yourself on the look out for our Khán's charities; you received a gun as a gift from the hand of Umar Khán; know in your heart that you are not worthy of great honour: You are their chief, and he is overlord of your chieftainship, for you came to our chief and became a refugee, and it was seen by all the chiefs in all four directions. You taunt me about the cattle at Kumbhi? You are but a cutter of phish on the hills. (The leaves of the phish or Chamorops ritchicana are cut to make matting.) You extol servants (not chiefs) My song is sung Gáhí, though you may not understand it. Take up the tracks of the chiefs who came to Bompur. In Manik's village blood has been shamefully shed, and formerly and lately cairns have been erected in memory of the slain.

IV.—Gáhí's final answer, following up the Rind legend, and taunting Sobha with cowardice.

Gáhí Gorish guslu: Kaloien Baloch gushí: Sobhár phasave dáis gushí.

Biyá o Relán shádhihání Sháhgkází cháravání

Majlis jawánes sarání Zír maní guftár-gálán Bar gwar jang-dosten sválán Band-bozh gálán dahena Phasaván sar pha sarena Gondalán serán manena Bar dan Sobháen nighoshí Olí guftárán shamoshí Zírí randá phírukeghá Bahr khant milká phitheghá Chi gushán man sháirára Dil-harífen sugharára Khashí Rindání shaghána Yád khan' olí jihána Gosh sobha mangihání Daftárí e Khosaghání Rand zurthe Makurání Rind Láshár dehání Rind Láshárí áwárá Rafthaghant azh Kech shahrá Akhthaghant Hárín malána Mulk mítáfá girána Bráth-yárí bahr-khanána Bí*thagh*ún bahr khamáná Má ki Jatoí yagsar athún Sím joá pha-do athún Mulk shahrá nemagh athún Roz bahr pha thír-dárán Chyárakhe ma Dhádar athant Sermá ma Khánpur athant Hand ma Rej deh athant E maní perá o rand-en Phuturen Rindání hand-en Nám ma ráján buland-en Agh thará itibár na-bítha Khasá go chamán na-dítha Khatte kuhne gwar niyáthen Gawáh sháhid kadh niyáthen Kissavání kissav-áthant Har-khase 'shi hanchosh-athant Man sáhíyán Sobha, káp káte Ne pha rand perowate

Sov drapá Jawánakeghá Júfo jhatá wathíyá Drogh bande záhiríyá Rást gushagh rást riwáh-en Drogh pha ímáná khatá-en Ar pha guftáre taiyár be Shedh-demá gawáhíyá de, Khatte márá khash phe-de, Biyá, azh shairán karár khan, Olí Rindán pha-phadhá khan Ninavakhta kissavá khan Surphadhení pha-gwará khan Main hadísán man dilá khan Sobha khapthaghe azh drikh-bálán Thai nighwari sher nalan Sunya thai Tuvi dálán Zurthívá jangá manívá Zulm-zorá sahibíyá Phrushthaghá be-ronaghíyá Zurthaghe mardán gihená Chandehá juhl-khenaghená Rúnghan Bádor várán Sanghar ládí mazárán Shán hilálen khohistáná! Muhammad Hán druh-giháná Zeb Buzdárá hilál-an Shaddav o khes go khawáhán Nind-nyádh gwar Umaráhán. Hál khárthán hánskárí Gwar mani Sardár Háná Gwar má báutí ki ákhtha Azh thai jangá rahetha Rúnghan o Kandor Bádor Shángo Sanghar dan Siríyá Band Bázen Bákharíyá Ráj athant símán darívá Drust khákhthaghant whazh-dilíyá Gwánkh Leghár charíyá Phurs, Sobha shairára Sughar o lekhí wathára Wházhá 'shí mehdhirára Wházhá thai dem ma shustaí

Lashkarán Jáme ma khushtaí Shakula her shamushte Mangehí shair pha hisáv-ant Gál pha uzhmár o kitáv-ant Majlise ma meraván bant Dan nighoshán nishthaghen sat Akhthaghen báut ki kháiyant Gird sardárán gihená Dostant cho chhamán doená Azh bachh-bráthán bingoená. Sh'á pha báután wathiyá Laji neshtha pha-phadhiya Bakhoen shwáí mangeho shán Kadh na khant chho ma Balochán Kkhthaghe lajján wathíyá Khashthaghant gudr lavílán Mál madí go galímán Basth-khárthant main vakílá Azh thai kotá garhená Thaí mehdhirá dír-zánaghená Dítha go chhamán doená Gosh Sobha o niyází Esh maní guftár-bází Tho ki guftáre kahitha Man dí pha goshán sunitha Túpaka dánga ganitha Chi ma sháná sar-ákhtha? Phurse' sardárá wa*th*íyá Jawánaká be-ámilená Bakhmal o bor go khawáhán Dáthaghen main Umará Hán Hán Balochána Nawáva Nukari bokhtha azh tháná Dátha hoten Jawánakára Pholathí olí ba-nindán Bithaghe báut go Rindán Khoh phish-buren nihengan' Phish phara khohá shaghán nest.

Translation.

Gáhí, son of Gorish, sings to the Kaloi Baloches: in answer to Sobha he sings:

Come, O Relán, to the assembly, king and hero of song; In this assembly of young chiefs, take my speech and song, carry them to our warloving foes. With propriety utter these few (lit. ten) words, answers given categorically, (head on head). They are arrows, of which a ser weighs a maund. Take them to Sobha, that he may listen to them, and forget his former songs. He will, he says, take up the track of our ancestors, he will distribute the paternal inheritance; what shall I say to the poet, to the cunning poet? Let him give up mocking at the Rinds and remember the former world. Say, O brave Sobha, you are the bard of the Khosas; you took up the track in Makrán, the lands of the Rinds and Lashárís.

The Rinds and Lashárís together set out from the city of Kech. They marched upon Hárín, taking the land of the country and dividing it among the brotherhood. We divided it by bows (i. o. a share to every one armed with a khamán or bow). We and the Jatois were united. At the border stream we separated into two parts, town and country we divided into halves, distributing our substance by arrow-stems. One-fourth were in Dhádar, we got our satisfaction in Khánpur, our dwelling was in an irrigated country. This is our track and trace, the abode of the true Rinds, a name exalted among chiefs. If you do not believe it, no one has seen it with his eyes, there are no ancient documents forthcoming, there were no witnesses to attest it, but there are tales upon tales, every one says that so it was.

I am right, Sobha, you are blind and deaf, nor is your footprint to be found on the track. Fear to speak of the victory of Jawának, take your bribe quickly, for you are manifestly inventing falsehoods. To tell the truth is the true custom; falsehood is a blot upon honour. If you are ready with a song, henceforth give your evidence, bring forth and show me your documents. Come! desist from any further poems, let alone the Rinds of bygone days, and tell stories of the present times. Surround yourself with men of understanding and lay to heart our traditions. Sobha, you have past the time for leaping and flying, your youth is under your feet, bare are the branches of your Túba-tree. You were carried away in battle with us, by the fury and force of our chief, you were broken ingloriously.

You were defeated by brave men, by the deeply-hating Chándyas, by our friends of the Rúnghan and Vidor torrents, by the mighty tigers of Sanghar. Honour to the faithful hill-country, to the perfectly-brave Muhammad Khán, jewel of the loyal Bozdárs, with silken turbans and garments, dwelling with Umar Khán.

A sure message I brought to our chief 'Those who have taken refuge with me, have ceased to be with you in war. The Rúnghan, Kandor and

Vidor territories, from Sunghar to the Sirí torrent, the Band Báz and Bákhar, who were outside your chief's territories, have all come of their own accord and mount at the call of the Laghárís.

Ask, O poet Sobha! reckon yourself up in your mind and call our chief 'Lord.' If our chief has not washed your face, then you did not kill Lashkarán and Jám. Have you forgotten the revenge taken for Shakul?

An account is kept of good poems, their words are enduring and are written in books, they are recited in the assembly and they remain firm in the (recollection of the) listeners. Whenever refugees have come or shall come to worthy chiefs, they are dearer to them than their two eyes or than young sons and brothers. You, for those who take refuge with you, have not given up shameful conduct for the future. Where is your great honour? No one does so among Baloches. You brought your disgrace upon yourselves (by the way you acted towards the refugees). They displayed anger and rage.

Their cattle and property had been seized by the enemy. Our vakil (demanded them) and brought them back bound from your fort! Your far-seeing chief saw with both his eyes then! Listen Sobha and attend. This is all my song. The song that you sang I also have heard with my ears. I have counted your gun-barrels. What honour is left to you? Ask your own chief, the unworthy Jawanak. Velvet and chestnut mares and silk did our chief Umar Khan give him. The Baloch Khans and Chiefs unloosed their white mares from their stables and gave them to the valiant Jawanak!

Ask of your forefathers how refugees fared with the Rinds. It is the phish-cutters on the hills that are the tigers. There is no disgrace in cutting phish on the hills.

VI.—A love-song.

(Said to be by Jám Durrak a Dombkí, a celebrated poet who lived in the reign of Nasír Khán of Kalát in the last half of the eighteenth century. He is said to have undergone great persecution from the Khán on account of his love for a lady of the zanána.)

O Samín be-phursá bihishtiye
Azh latífá nemaghá khaiye
Man gulá dema mail khuthe doshí
Bairamo ásí sár khutho mátos
Bo azh bríkhán rapthaghan whashen
Hijr manán momín janant pásán
Cho kahírání áraven ásán
Be-karár-án ma nemshafí pásán

Pha whashi o dost hubbo iklásás Zillatán sábsáre deáe jáná 'Nah' na khanás pha dost pharmáná Cho isparán dempán maní jáne Chábuk o chashm díd paikáne Kahr amulání girgiren názant Dadame gár-ant dadame báz-ant Nain dafá gír ki gál khanán rosben Nais manás kurzat mazál chosh-es Pha dafá mahlíjá dí ján áyás Nishtho duá go hawás roshe Wa hudhá merhán man dilá shefi Er-khafi dost azh thangaven thakktá Biái rodhána cho chyárdahí máhán Masaron bí cho Akbare Sháhán Gudá azh durr-chíren dafá phursán 'O badhashkání grán bahá lálen Mára thai loghwaren saren saughan Irmirí gon-khapton annágáhí Phar thai sahth sakalen nyádhán Hon bahá ban pha sakales khulkás.'

Another Song by Jám Durrak.

Doshí dil-raváhen jání Sartáj o samand khádání Gwashthom pha dafí phanání Osá thau machar haivání Gird-i áravás phirwání Chandí áshkánrá ziyání Kulfo phrushthaghán shakání Ishk o manitha hakání Gwashthom keghadhen sázárá Durchíno hazár názárá Phulkand o shakar guptárá O hál i fakíre esh-an Zirde azh phirádhán resh-an Kn ki málik dozdár-an An azh munkirán bezár-an Jám jámaván kháksár-an Harzatá darúd kár-an

Sháhen kirdagár ásár-an Gwafshe nem-shafán nál-an.

Translation.

The rain that un-asked for falls from Heaven comes from the direction of the beloved one. Last I met a love face to face. The lightning springs forth, it is my love that has awaked me. The scent of her locks has sweetly seized me. The pain of separation sharply stings me in the night-watches, I spring up like the flame of Kahír-wood (*Prosopis spicigera*), I am without rest in the midnight watches, for the sweetness of meeting with my love. Give my body some breathing-space from pain, I will not say 'No' to my loves command, my body is as a shield stretched forth. Let my eyes be gladdened by the sight of my fair one, let the pain caused by my lady be a little appeased; sometimes it disappears, sometimes it increases. I cannot use my mouth to speak by day, I have no strength, she is so strong, to come to meet and speak to her.

I sit and pray for that day: 'O God, be merciful, and incline your heart to me.' Let my love come down from her golden throne, let her come growing like the waxing moon on its fourteenth day, let her be in front of me, and I shall be king Akbar. Then I shall ask from her pearly mouth 'O priceless ruby like the badhashk fruit, make me your husband, bound by oath, my heart has been irrevocably taken possession of, I will live for the sake of your jewel-like beauty, I will spend my blood for you, fairest of beings.'

Second Song.

Last night I saw my heart-enchanting love, the crown and ornament of women. I spoke to her with my lips and said 'Do not behave foolishly, like the moth flying round a flame, O bane of many lovers.' The locks of hesitation are burst open, I have obeyed the call of true love. I said to my beautiful love, 'O fair one of a thousand wiles and sweet sugared speech, this poor wretch's state is this, his heart is galled with his complaints, he who is a chief and true friend is apart and averse from the avaricious. The heart of Jám is covered with dust. It remains but to say bism'illáh in the divine presence, to remember the King and Creator, and to pray through the cold midnight.

Riddles, Proverbs, &c.

The Baloches are very fond of riddles, which are always in rhyme. They are of a primitive type and generally defy solution. The more far-fetched they are, the more appreciated. Those first given are by Bráhim a Shambání who died about two years ago. He was celebrated for his riddles as well as for more serious compositions.

Bujhárat.—Ya shai jawain ulkahá astá
 Duzhmaneá resentha-ish khashtha
 Bánghavá pahre ráh sará gwastha
 Go minnat merhán niyadh dastá
 E bujhárat Bráhimá bastha.

Bozh. Warnái.

Riddle.—There was one good thing in the world; an enemy has pursued and turned it out. In the morning watch it passed along the road. Neither begging nor praying will bring it back again. Brahim composed this riddle.

Answer.—Youth. (The enemy is old age.)

2. Bujhárat.—Hudhái kurzat o kárá
Zamín nestath o dighárá
Be khishthaghen khishárá
Hudhái kurzat o kárá
Sabz o phul bahárá
Pha phashaghá di taiyárá.

Riddle.—By God's might and power
With neither ground nor soil
Without a field being ploughed
By God's might and power
A green plant has flowered
And now its fruit is ripening.

Answer.—This was composed on seeing an ear of corn growing on the beam across the mouth of a well.

Bujhárat.—Bráhimá pairí gwashthaghá gále
 Díthaghún 'chie rangá be hále
 Rangen kojhá andaren lále

Bozh. - Askhohe.

Riddle.—Last year Brahim said 'I saw something of an indescribable sort. Its appearance was foul, but there was bright red within.

Answer. - A flint.

4. Bujhárat.—Ya shai jawain ulkahá yaká
Go jherave jangán sadhbare saká
Har-khase kháíth, jathí wathí chaká
Man na gindání jagahe dhakká
Gosh dánáhá shára bozh wa hakka

Bozh.-Chháth.

Riddle.—There is one good thing in the world, a thousand times attacked with disputes and quarrels; every one comes and throws it over

himself, yet I cannot see anywhere a sign of hurt. Let the wise ear attened and guess it right.

Answer .- A well.

5. Bujhárat.—Ya drashke jorentha páken hudháyá Ma zamín phushtá pha jinden razáyá Bund yaken-í lámb-en duáyá Yake rekh bítha, yake sawáyá

God has planted a tree, of itself it has grown up on the face of the earth; the root is one, the branches two; one is dust, the other ashes.

Answer.—The tree is mankind, the branches Musalmáns and Hindús.

6. Talabí naukarant kharde ajab bhat Kadam pha lekhav-ant-ish kár o khidmat Hame fauj dhurá be hathyár en Phithí phoshindaghán yák o tawár en Hamodhá lashkar khosh o khushár en

A few servants of strange forms
They step by calculation on duty and service
They are an army bare and unarmed
Moving at the voice and call of other men
And there the army meet death and slaughter.

Answer.—The pieces at chess.

 Nishtho dithom pha nadhar An shahr be sáh watan Ahání adh jang o jadal Nyámjí nawant yake dígar.

Sitting I saw with my sight
A city and masterless country.
There was war and strife between them
And no umpire betwirt the one and the other.

Answer.—A game at chaupar.

 Wiláyat thars en, dost bar-karár-en Ravaghá gohár kisánaken taiyár-en Na rothí máth, bachh olá sawár-en Phith nestení, phíruk haiyát-en

The country (in) fear, the mistress in comfort
The little sister ready to start
The mother will not move, the son is already mounted,
The father does not exist, the grandfather is alive.

Answer.

The above contains a series of puns on the names of a family, partly, in Sindhí. The name of the country Pádar contains in the last syllable 'dar' the allusion to fear. The name of the mistress Begam, read as 'begham,' is the equivalent of 'bar-karár.' The sister's name is Haurí, the mother's Gaurí, meaning in Sindhí light and heavy. The son's name Sháhsawár, the fathers Gháibí, and the grandfather's Haiyát explain themselves.

9. Hudhá pakko kuzraten bandá pálíth
Rusúl Muhammad en ummatwálí
Hazáren bandagh yaken thálí
Chamodhá khas no roth horg o khálí
Hamodhá giptho harchí dí wártha-ish
Hamá whán zurtho loghá dí ártha-ish
Gudá jatho bhorentho thálí ujártha-ish
After an invocation to God and the prophet—

There are a thousand men to one dish,

No one goes thence empty-handed

There they take and eat everything

They take up the dish and carry it home,

And having thrown it down and broken it they leave it bare.

Answer.—This contains a pun on thálí, which means the hedge round a threshing-floor as well as a dish. After every one has carried away the corn he wants, the hedge also is torn down and carried away.

10. Dánki sháhá parwaren khaptha man logh buná Ní ki bandaghán razentha bítha pha husn o pharán Wash hadíth o khush lisán Roth go phulen ambalán

As long as God had charge of him he lay at home;
Now that men have constructed him he has become fresh and fair.
With sweet discourse and pleasant speech
He walks about with his fair companions.

Answer.—A man with a wooden leg.

11. Pyáláe phuren dítha májáí Nishthaghá lálo nestathí dáí Pyáláe wártho lál shahíd bítha Chonán ki kullen álímá dítha

I saw a cup in a certain place
A bright one sat down without an attendant
This ruby like one drank up the cup, and then died
So that all men saw it.

Answer.—The flame of an oil-lamp which goes out after having drunk up the oil.

12. Do gohárán dítha ambází
Ajab khush ant gwar ambází
Nainí suratá khamí
Yake khor dígar chamí
I saw two sisters embracing
Very happy at the embrace
There is not the slightest difference in their appearance
One is blind and the other has eyes.

Answer.—The reflection in a mirror.

13. Phairí khákhtán pha gidhár Man Bakri shahr gwara Bolí athí washen tawár Dastán gipthí nar-mazár.

> Yesterday as I passed along the road In the town of Bakkar I heard a very sweet voice But when I seized it, it was a fierce tiger.

Answer .- A snake.

14. Proverbial sayings.

Kahne litir o phíren zál Warná sará sár-bár. Old shoes and an old wife Are the burden of a young man's life.

Savzen cho hithen, charpi cho meshi dumbaghan.

As green as young corn, as fat as long-tailed sheep.

This saying refers to the Gwar or wild pistachio (Pistacia khinjuk).

Khatán sokhtha áfá phúkí wárth.

One burnt by hot milk will not drink even water without blowing on it.

This corresponds with the Hindustání proverb 'Dúdh ká jalyá chánchh hí píwat phúnk,' or the English. 'A burnt child dreads the fire.'

Málá sar-dai várá dosh.

Let the cattle go and milk the hedge.

This answers to 'Penny wise and pound foolish.'

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ERRATA.

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3, line 8, read 3 for
                      pronounced for pronouncd.
    5,
            88,
                 ,,
                      nyánwán for nyánwán.
    7,
             9,
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        "
            33,
                      shákká
                                  shákhá.
   16,
                 ••
                      marde
                                   mardá.
             8,
   17.
                      kithán, thán for kithán thán.
            18,
   24,
                 "
                      biyár for riyár.
   25,
            35,
                      see it himself for see himself.
            14,
   82,
                             nowhere hizhgarnen.
                            nowhere hizhgarnen
elsewhere thihandá.
   33,
                read welcome for welceme.
   37,
            25,
                      phádh-ágh for Pádh-ágh.
            20,
   42,
             24.
                       bilí for kilí.
   43,
                      amnám for annám.
             7,
   44.
                                   an-
           10-14, "
                       án —
   44,
                                "
                      leeward
                                  lee-ward.
   46.
             16,
                                "
                                    .báqí باقي
                      " bákí باكى
   47,
             12,
                  ,,
                                    baterá.
   47,
             84.
                       baterá
                  33
                       baraqh
                                    beraqh.
   49.
             5,
                  "
            10, dele P. burú, Skr. bhrú.
   49,
            10, after برويث baroeth add برويث barwan, s. the eye-brow.
   49,
                  P. burú, Skr. bhrú.
             13, read panwar for panwar.
   54,
                       phashk "phaskk.
   57.
              4,
             21, add cf. Pashto jowal after to chew.
    64.
             23, read oxen, mate for oxen mate.
    66.
             27, add Pashto after joru.
   66,
    67,
                      Р.
              9,
             25, read dágh for dágh.
    71,
    72,
             33,
                       tear
                              ,,
                                 burst.
```

```
Page 74, line 12,
                       dáragh for dáragh.
             20,
                       sará sá " sará sa.
     85,
          ,,
     87,
             32,
                               " samb.
                       sumb
                   "
             13,
                       Maurorum for Mauroram.
     93,
                  ,,
             13,
                       sixtieth ,, sixth.
     95,
                  ,,
                       khambar. Kambar for khambar-kambar.
     98,
             10,
                       گراند for گراند
    105,
             13,
                   **
    105,
             31,
                       giryán
                               ", girgán.
             21, after گوانگچ gwanech, a camel driver.
  ,, 108,
    108,
             گوزان for گوذان 83, read
                                " fiesh.
             26,
                       flesh
    109, ,
              3,
                      گوماذ
                               گومان ..
  ., 110,
             84, after کیانی giánch insert کیانی giyáf, fortile, extensive.
  ,, 110,
             2, read Salix for Salia.
  ,, 111,
  ,, 114,
             24,
                      man ,, mau.
          99
                  "
 ,, 115,
             16,
                      mán-deagh for man-deagh.
             27,
                      máhkání
                                  " mahkání.
    115,
          ,,
                  "
                                  " leap!
  ,, 117,
             21,
                      leap.
                                  " mahisk.
             81,
                      mahisk
  " 119,
             30,
                      neghar. نيغار " negha نيغا
  ,, 124,
          ,,
                  12
                      níkah
  ,, 124,
             81,
                                    nekah.
                 22
                      vakhtá
                                     vakhat.
 ,, 125,
             8,
          "
                 "
                                  ,,
                      P. khwája "
                                     P. khwaja.
  ,, 125,
             16,
             whán tkár, master, owner. وهانتكار whán insert وهان
 ,, 127,
         عبانی for عباسی 26, read عبانی
  ,, 127,
         , 33, after هار halení insert هار himár, tender, delicate,
  ,, 129,
                   beautiful.
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JOURNAL

OF THE

ASIATIC SOCIETY OF BENGAL.

VOL. XLIX.

PART II. (NATURAL HISTORY, &c.)

(Nos. I to IV.—1880.)

EDITED BY

THE NATURAL MISTORY SECRETARY.

"It will flourish, if naturalists, chemists, antiquaries, philologers, and men of science in different parts of Asia, will commit their observations to writing, and send them to the Asiatic Society at Calcutta. It will languish, if such communications shall be long intermitted; and it will die away, if they shall entirely cease." SIR WM. JONES.

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1880.

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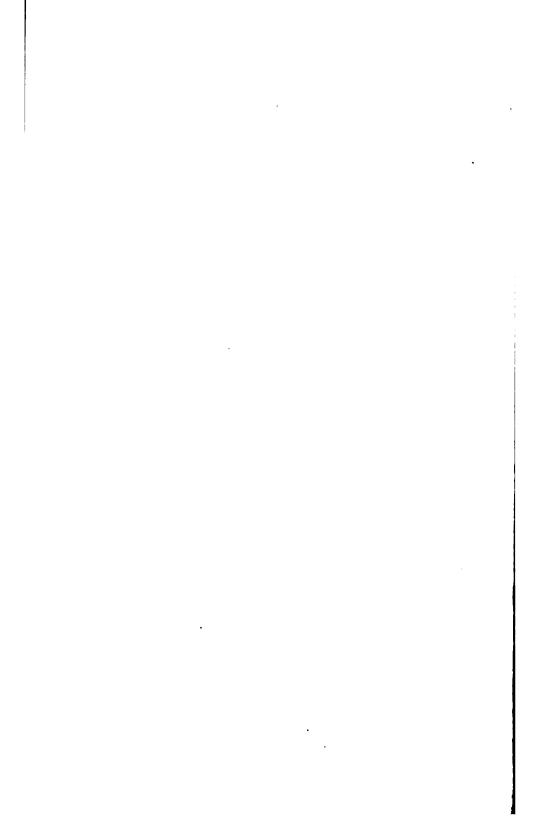
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- No. I.—Containing pp. 1—84, with Plate I, was issued on June 26th, 1880.
- No. II.—Containing pp. 85—134, was issued on August 30th, 1880.
- No. III.—Containing pp. 135—180, with Plates VII—XI, was issued on December 14th, 1880.
- No. IV.—Containing pp. 181—250, with Plates II, III, VI and XIII, was issued on March 7th, 1881.

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ERRATA AND ADDENDA.

p. 14. Bones of fishes from the Trias of Tibet referred to under the head "Cretaceous," should have been mentioned in the preceding paragraph.

p. 24. At the time of writing the notice of Siwalik Carnivoras I had not seen the paper by Mr. Bose on that subject, and consequently was not aware that Felis grandicristata and Canis cautleyi are merely provisional species. It should also have been mentioned in treating of the genus Ursus, that there is in the collection of the Indian Museum, a canine-tooth from the Irawadi Siwaliks probably belonging to this genus.

p. 31. In treating of the Pleistocene Proboscidia it should have been mentioned that the first described teeth of Mastodon pandionis are said to have been obtained

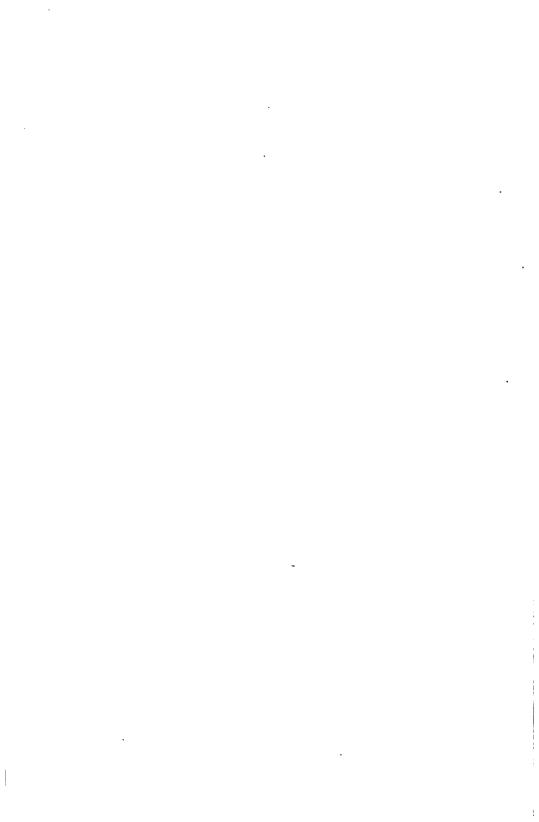
ADDITIONAL ERRATA.

Page 182, line 27 from top, for Five read Two.

- " 186, " 8 from top, " "angulata-lunaris" read "angulato-luna-
- " " " 2 from bottom, omit "it is figured here".
- " 190, " 19 from top, for "contingens" read "contingentibus".
- " 191, lines 24 and 26 from top and in footnote, for "Situla" read "Sitala".
- " 192, bottom line, for "ponsa" read "pansa".
- , 216, line 4 from top, for "specimen" read "specimens".
- " 221, " 4 from top, for "I have described the species" read "I have never described the species."

The mistakes on pp. 182 and 221 are important.

$+ 0.020194 R_1 \approx 0.2$	75 R ₁
Should read	
	Diff.
+ $0.020194 R_1 \approx 0$	275 R ₁
• Q. J. G. 8	. Vol. XXXVI. p. 119.



JOURNAL

OF THE

ASIATIC SOCIETY OF BENGAL.

No. I.—1880.

I.—On a Simple Method of using an insignificant Fraction of the Main Current produced by a Dynamo-Electric Machine for Telegraph Purposes.—By Louis Schwendler, M. Inst. C. E. &c.

(Received 29th October; read November 5th, 1879.)

The currents which a dynamo-electric machine is able to generate through a small external resistance, are so enormously strong and also so constant and exceedingly cheap, that I have always thought it would be of technical as well as of economical importance to use them for signalling purposes. The difficulty only was how to solve the problem practically. Manifestly, the currents could not be produced through the telegraph lines, in the ordinary manner of applying dynamo-electric machines, for, in the first place, telegraph lines offer high resistance, and, in the second place, the use of the closed-circuit system would become imperative. However, some time ago a very simple method occurred to me which appears to contain the germs of practical success, and, having lately made some experiments on the subject, I do not hesitate to communicate the result.

Suppose we have a dynamo-electric machine, the two terminals of which are connected by a resistance r through which any kind of useful work is to be performed by the current.

For instance, during the night, r may consist of an electric arc, and the useful work done by the current is given out as light for the signalling office; or during the day-time r may consist of another dynamo-electric machine which acts as an ordinary electromagnetic engine, performing

some useful mechanical work, i. e., pulling the punkhas, lifting messages, producing a draught of cool air, &c.; or the current may be made to pass through a galvanoplastic apparatus in connection perhaps with the Surveyor General's Office, &c.

Now connecting the negative pole* of such a dynamo-electric machine to earth, the positive pole to all the lines terminating in a telegraph office, while the two poles are permanently connected by the resistance r through which the current produces the useful work above-mentioned, then it will be clear, without demonstration, that all the lines so connected can be provided with signalling currents (which are exceedingly weak as compared with the strong main current) by simply tapping the main current, and that without perceptibly reducing it, i. e., without affecting the useful work performed by the main current through r. Supposing that the useful work performed by the main current repays all the expenses connected with the erection and working of the dynamo-electric machine, then obviously this would be a method which would supply the signalling currents for nothing. This might be an inducement for telegraph-administrations to introduce the electric light, since they would get the signalling currents into the bargain, and the costly and cumbersome galvanic apparatus might be dispensed with.

An example will show this more clearly. A Siemens dynamo-electric machine of medium size can easily be made to produce through an electric arc a current of 30,000 milli-oerstedts, of which not more than 3 milli-oerstedts are required to work the Siemens's polarized relay with engineering safety. Suppose that the sent current is made equal to twice the current which is required to arrive, we have the following calculation for Calcutta office:—14 long lines terminate at Calcutta, hence 14 × 6 = 84 milli-oerstedts would (as a maximum) have to be tapped off from the main current of 80,000 milli-oerstedts. This represents a loss of only $0.28^{\circ}/_{\circ}$,—which is so small that not even the most sensitive eye would be able to detect any variation in the light.

Hence in this case we would feed the Telegraph lines with currents which actually cost nothing, as the electric light alone would repay all expenses.

During my recent light experiments in London, it was experimentally established that the current in milli-oerstedts which a dynamo-electric machine is able to produce, can be expressed as follows:—

$$C = E \left\{ \frac{1 - e^{-K \left(\frac{v}{r+m}\right)^{s}}}{r+m} \right\} \times 1000$$

• In India we use positive signalling currents.

E and K are two constants for any dynamo-electric machine. E is an electromotive force in volts; K is of such dimensions that $v \checkmark \overline{\mathsf{K}}$ represents an electrical resistance; m is the internal resistance of the dynamo-electric machine; τ is the external resistance through which the useful work by the main current has to be performed.

m and r are to be expressed in ohms. The resistance of the leading wires has been supposed nil.

If we call R the resistance of a telegraph line, which we wish to feed from the main current, then the signalling current passing into that line when the main current is tapped would be

$$\frac{Cr}{R+r} = E \left\{ \frac{1 - \frac{r}{e} \left(\frac{r}{r+m}\right)^{3}}{r+m} \right\} \times \frac{1000 r}{R+r}$$

and this current, in the case of the Indian lines, should not be less than 6 milli-oerstedts. Hence we have the following equation:—

$$\mathbf{E}\left\{\frac{1-\frac{\mathbf{K}\left(\frac{\mathbf{v}}{r+m}\right)^{2}}{r+m}\right\}\times\frac{1000\ r}{\mathrm{R}+r}=6$$

from which r can be calculated, since E, K, m, v and R are known.

I need scarcely point out, that as R is invariably so large that r can be neglected in comparison with it; the current in *one* line only depends on the resistance of that line, and not on the resistance of the other lines in connection with the dynamo-electric machine. Hence the signalling through one line is not influenced by the signalling on other lines; and in this respect the method is on a par with signalling through different lines by separate batteries.

We will take a special case.—For a Siemens's medium machine, making r=3, we have a main current of about 17,710 milli-oerstedts, and the current passing into a line of 8000 resistance (800 miles of $5\frac{1}{3}$ wire) would be 6.6 milli-oerstedts. Supposing that all the 14 lines at Calcutta office are to be supplied with 6.6 milli-oerstedts each, the current carried off would be $6.6 \times 14 = 92.4$ milli-oerstedts, or $0.5\,^{\circ}/_{\circ}$ of the main current.

It is best to make all the lines equal in resistance by adding to the shorter lines some artificial resistance. This measure would prevent a dead earth (occurring on one of the lines and close to Calcutta) from having any effect on the working of the other lines. In Europe, where the lines are much shorter, the signalling currents supplied by a given dynamo-electric machine, working through a given resistance r, could be much greater than 6.6 milli-oerstedts.

For any given R (resistance of the line) the currents can be increased by selecting a dynamo-electric machine with the right internal resistance.

The advantages of the method appeared to me sufficiently great to justify a practical trial:—

Experiment, October 11, 1879. With a Siemens's dynamo-electric machine (medium size) I produced a powerful electric light; and between the poles of the dynamo-electric machine I connected up four-artificial lines, each of 10,000 units resistance, with relays ranging between 500 to 1000 units. These four parallel circuits worked very well, singly and simultaneously. No variation of the electric light during telegraphing could be noticed, even when the line resistance was reduced to 1000 units. Further, the resistance of one line was increased to 20,000, and the signalling currents were still sufficiently strong (1.6 milli-oerstedts).

Experiment, October 14, 1879. Same as above; but a branch current was conveyed by the store-yard line (from the store-yard where the dynamoelectric machine with its electric light was put up) to Calcutta signalling-office (4 miles), and one of the Agra lines (850 miles in length) worked by this current.

The sent current, measured at Calcutta, was 9.6 milli-oerstedts; the received current, measured at Agra, 1.85. The great loss was due to the exceedingly low insulation of the line near Calcutta. It is now the breaking up of the monsoons, when the climate in lower Bengal represents almost a hot vapour bath.

Several messages were sent to Agra, but no variation in the electric light could be observed.

II.—On the Occurrence of the Musk-Deer in Tibet. By R. LYDEKKER, B. A.

(Received November 17th, 1879.)

Some degree of doubt seems, hitherto, to have prevailed among naturalists whether the Musk-Deer (Moschus) occurs on the Tibetan plateau, or whether it is confined to the wooded districts of the Alpine Himalaya. Thus in a paper contributed by Mr. W. T. Blanford to the 'Proceedings of the Zoological Society of London,'* the author says that he has grave doubts whether the Musk-Deer occurs anywhere on the Tibetan plateau. In a paper published by myself in the Society's Journal,† I mentioned that, from having seen skins in Ladák, as well as from the fact of the Ladákis

having a name for the animal, I was of opinion that the Musk-Deer must occur somewhere in Tibet, though I had at that time no positive proofs to offer. Lately, however, I have obtained such evidence as seems to leave no doubt that this animal should be reckoned among the fauna of Tibet.

Firstly, it will, I think, be generally admitted that the musk-pods of the Musk-Deer are an important article of export from Tibet to India.* Although this affords prima facie evidence that the Musk-Deer occurs in Tibet, yet it might be objected that this musk was first taken from China to Tibet, and thence exported through Nepál or Ladák to India; I, therefore, now proceed to bring forward the more direct proofs of the occurrence of the animal in Tibet proper.

The earliest evidence which I have to notice, is that of the great traveller Marco Polo. † That writer mentions the occurrence of the Musk-Deer at a place which he calls Ergiul, which Colonel Yule locates to the north of Tibet, and south of the great Gobi desert, in latitude 40°. From Marco Polo's description, there can be no doubt of the identity of the animal referred to with the Musk-Deer, though he commits the error of mentioning a pair of lower as well as upper tusks. Again, the same traveller! mentions the occurrence of the same animal in eastern Tibet, probably somewhere near the longitude of Lhása, and also that the Tibetans call the animal Gureri.

A later traveller, Mr. Bogle, the envoy of Warren Hastings, describes § most circumstantially the hunting and capture of a Musk-Deer (or, as he calls it, Musk-Goat) at Rinjaitzay, which is situated north of the Tsánpú river near Shigatze in Tibet. Mr. Bogle describes the animal as being hornless, coated with stiff hair, and with tusks depending from the upper jaw of the male: he also mentions that the Tibetan Musk-Deer is of a lighter colour than the Musk-Deer of Bhútán. This description leaves no possible doubt as to the animal referred to.

General Cunningham || mentions that the Musk-Deer (known to the Ladákis as Lá) is found in Tibet as well as in Kashmir.

During the past summer, I met in Lahul with a Tibetan who had formerly occupied a high official position at Lhasa, and who informed me,

```
    Markham, 'Tibet.' Int. p. cxxii, p. 197.

  Hodgson 'Trade of Nepál.'
  Cunningham. 'Ladák,' p. 242.
† Yule's 'Marco Polo,' Vol. I, p. 267.
‡ Yule, loc. cit., Vol. II, p. 37.
```

Markham, loc. cit., p. 114.

Loc. cit., p. 202.

that the Musk-Deer was of common occurrence on the Tsánpú river in the neighbourhood of Lhása.

Mr. W. H. Johnson, the Governor of Ladák, informs me that the Musk-Deer is found in the country below and to the east of Lhása, along the course of the Tsánpú river. The musk brought from this district, Mr. Johnson says, has wrongly acquired the name of Khoten musk; this seems to have originated from the fact that when Khoten was a large Buddhist city, and important trading place, the musk was carried there from Lhása, and thence to India. Mr. Johnson also observes that the Musk-Deer occurs only where the birch tree grows.

The whole of this evidence taken together appears to me to afford abundant evidence as to the occurrence of a species of *Moschus* in Tibet, though I have no means of knowing whether it be the same as *M. moschiferus*. The Musk-Deer is of common occurrence in Bhútán, and it appears to me to be probable that it extends north of that district in most of the open countries up to Tibet, and thence across, or round, the Gobi desert into Siberia.

The occurrence of the Musk-Deer far in on the Tibet plateau is a fact of considerable importance, as it is the only instance of any of the large mammals of the forest clad Alpine Himalaya extending its range into the dry and desert regions to the north.

In my former paper, quoted above, I thought it probable that the Musk-Deer occurred in Ladák; this, however, I now find is not the case; I can find no evidence of the animal occurring anywhere in the upper Indus valley.

III.—Note on some Ladák Mammals.—By R. LYDEKKER, B. A.

Otter.—In his report on the Mammalia of the second Yarkand Mission* (p. 32), Mr. W. T. Blanford mentions that the late Dr. Stoliczka, in his notes, referred to the occurrence of a small species of otter (Lutre) in the Indus at Leh, but was unable to procure a specimen.

During the past summer I purchased at Leh a flat skin of an otter, said to have been obtained from the Indus at Shushot, near Leh. This skin is of very dark colour superiorly, and the length of the body-part is about 30 inches; the tips of the hairs are paler. Unfortunately, neither the skull nor the claws remain in my specimen, so that specific determination is quite impossible. The skin, however, seems to be very like that of the European

 ^{&#}x27;Scientific Results of the Second Yarkand Expedition,' Mammalia, by W. T. Blanford. Calcutta, 1879.

otter (*L. vulgaris*), and the animal, therefore, may very possibly belong to the same species as a skin obtained by Major Biddulph in Gilgit (? from the Indus), and which Mr. Blanford, in the above-quoted note, thinks is very like *L. vulgaris*.

I learn from Mr. Elias, the British Joint-Commissioner at Leh, that otters are said to be of common occurrence at the bridge which spans the Indus below Leh; these otters live in the stone-work piers of the bridge. I may add that Mr. Elias has promised to endeavour to procure a specimen of the skin and skull of one of these animals.

Dr. Stoliczka speaks of the Leh otter as being a small species; since, however, he never procured a specimen, and as my specimen is a large skin, it is probable that Stoliczka's estimate of size was not exact.

Marmots.—I cannot quite agree with Mr. Blanford* in calling the Red Marmot (Arctomys caudatus) the common marmot of Ladák, as it appears to me that the species is only found on the outskirts of that region. I have procured specimens of that species on the range between Kashmir and Tilel (Kishenganga valley), on the pass between Tilel and Drás, and on both sides of the Zoji-Lá, separating the latter place from Kashmir. I have. however, never seen this species in the more interior parts of Ladák, where it appears to me to be replaced by Arctomys himalayanus, or the Yellow Marmot, which appears to me to be entitled to be called the "Ladák Marmot" par excellence. I have seen or procured specimens of the latter species, from the mountains above Khalchi, on the Indus: on the pass separating the Markha river from the Gia river, to the south of Leh: and, still further south, on Kiang-Chu Maidan, in Rúpsú; to the north of the Indus in Ladák, on the Chang and Kai passes, forming the watershed of the Indus and Shyok rivers; around the Pangong lake; and in the Chang-Chenmo valley. Arctomys caudatus seems to me to be confined to the country on the confines of the rainless districts, while A. himalayanus occurs only in the inner, and thoroughly Tibetan, districts.

In the field, the two species can be at once distinguished by their respective cries. The cry of the Red Marmot is a peculiar long screaming whistle of great shrillness: the Yellow Marmot on the other hand utters a short chirping bark. It is not easy to convey an idea of the two sounds to the reader, but when they have been once heard in the field, they never can be mistaken for one another.

I should be much inclined to doubt the suggestion of Mr. Blanford† that the marmot said by Dr. Stoliczka to range up to a height of 17,000 feet in Ladák is A. caudatus; it is much more likely to be A. himalayanus, which I have killed above 18,000 feet; the former I have never seen above 14,000 feet (Drás and Tilel pass).

^{*} Loc, cit. p. 37.

IV.—A Sketch of the History of the Fossil Vertebrata of India.— By R. LYDEKKER, B. A.

(Received January 6th; read February 4th, 1880.)

As far as I am aware, there has not hitherto been written a complete history of the whole Fossil Vertebrate Fauna of India, as far as it is at present known to us, and I have, therefore, thought that it may interest many members of this Society, as well as others, to know something of the extent and affinities of this fauna, without the labour of wading through the various works in which its history is recorded. The history of the Fossil Vertebrata of India is, indeed, intimately connected with this ancient Society, since some of the earliest workers in this branch of enquiry were formerly among its members, and many of the results of their labours are to be found scattered through its earlier records. Pre-eminent among those workers will always stand out the names of Baker, Durand, Cautley, Colvin, Falconer, Hislop, M'Clelland, and Spilsbury. And it must always be remembered, to their honour, that these workers in this most interesting department of palæontology were solely amateurs, and that in their time the study of vertebrate palæontology in this country was encumbered with difficulties of which we, at the present day, can have no adequate conception. The labours of Mr. Hislop were mainly expended in searching the Gondwana rocks of the Central Provinces, from which he obtained many interesting remains of reptiles, batrachians, and fishes; Col. Syker' collections were chiefly made among the fossil fishes of the Deccan; while the field of labour of the other workers lay mostly among the mammaliferous beds of Northern India, and the Narbada (Nerbudda) valley.

I very much regret to say that since these illustrious workers, no amateurs in India seem to have entered upon this interesting field of research, and during the five years which I have been upon the staff of the Geological Survey of India, we have not, I believe, received, in the Indian Museum, a single fragment of a fossil vertebrate from a non-professional worker. It is partly in the hope that this paper may reach the eye of amateurs interested in natural science, and especially of those who lead a wandering life in India, and induce them to endeavour to collect specimens of vertebrate fossils for the Indian Museum, that it has been penned.

Apart from members of the Geological Survey of India, to whom I shall refer presently, there are other workers who, though not members of this Society, have contributed largely to the history of the extinct verte-

brate life of India. Noticeable among these are the names of Buckland, Crawfurd, and Clift. Crawfurd, on his return from his mission to the court of Ava in 1826, brought back some Tertiary mammalian remains from the valley of the Irawadi, which were among the first obtained in Asia by Europeans, and which were subsequently described by the late Mr. Clift in the 'Transactions of the Geological Society of London.'* In the same volume of the 'Transactions,' a memoir was also published by the late Dr. Buckland Another memoir also appeared in the same volume by on the Ava bones. Mr. Pentland, on certain mammalian remains from the Siwaliks of Sylhet, collected by Sir T. Colebrooke. As you are doubtless aware, the fossil vertebrate fauna of the Siwaliks and the newer Narbadas, were subsequently fully illustrated, and in part described, by our former illustrious associates, Falconer and Cautley, the results of whose labours are abundantly dispersed through our Society's publications, and displayed in that now classic work the 'Fauna Antiqua Sivalensis.'

Dr. Charles Murchison, the editor of the 'Palæontological Memoirs' of Dr. Falconer, has rendered one of the most important services to the cause of vertebrate palæontology in this country, by collecting and publishing the scattered notes and memoirs of that distinguished palæontologist. Professors Owen and Huxley have contributed largely to our knowledge of the fossil Reptilia and Batrachia of India; while the fossil fish have been enriched either by the discoveries or the writings of Messrs. Egerton, Miall, Sykes, and Walker.

A valuable memoir on the extinct Siwalik genus Sivatherium was contributed to the 'Geological Magazine' by Dr. Murie; another on Bramatherium, by Mr. Bettington and Professor Owen, to the 'Journal of the Royal Asiatic Society.' A few Siwalik fossils collected by the Messrs. Schlagintweit were described in the German 'Palæontographica' by the late H. von Meyer. The late Dr. J. E. Gray also determined a few of the Indian fossil reptiles. Professor A. Milne-Edwards determined some Siwalik bird-bones. Some mammal-bones from the Tibet Tertiaries were determined by Mr. Waterhouse.

Among the later contributors to our knowledge of the fossil vertebrata of India must be mentioned Professor Rütimeyer, who has afforded valuable information on the Siwalik ruminants in the British Museum; and Mr. P. N. Bose, who has described some of the fossil Siwalik Carnivora in the same collection. Mr. Davies, of the British Museum, has also contributed to the 'Geological Magazine' a valuable paper on Siwalik birds. Professor Leith Adams has published some notes on Elephas namadicus in the Palæontographical Society's publications.

The above names are only the chief among the workers in Indian

vertebrate palmontology who are unconnected with the Geological Survey of India. Of the former or present officers of that department, I must mention, among discoverers, the names of Messrs. W. T. and H. F. Blanford, Fedden, Foote, Hacket, Hughes, Medlicott, Theobald, Tween, and Wynne, and, among writers, Messrs. W. T. and H. F. Blanford, Foote, Oldham, Stoliczka, Theobald, Waagen, and, lastly, myself.

Minor contributions, in the way both of specimens and papers, have been made by other gentlemen, all of whose names it would be both tedious and difficult to bring together, but for whose exertions the workers in this branch of enquiry have, none the less, good cause to be grateful. Among these names I may mention, Bell, Dr. (Ichthyolite from Kach); Blyth, E. (Siwalik Mammals); Burney, Col. (Ava Vertebrates); Burt, Lieut. (Jamna Bones); Cantor, T. (Siwalik fish-skull); Carter. Dr.: Colebrooke, Sir T. (Tibet Tertiary Mammals); Dawe, W. (Tertiary Vertebrates); Dean, E. (Jamna Mammals); Everest, Rev. R. (Siwalik Vertebrates): Felix, Major, (Narbada Mammals); Foley, Capt. (Diodon from Ramri Island); Frazer, Capt. (Narbada Mammals); Fulljames, Capt. (Perim Mammals); Godwin-Austen, Col. (Siwalik Mammals); Gowan, Major (Archegosaurus from Bijori); Hügel, Baron (Perim Fossils); Ewer. W. (Siwalik Vertebrates); Lush, Dr. (Perim Vertebrates); Ousely, Col. (Narbada Mammals); Pepper, Miss (Perim Mammals); Phavre, Sir A. (Ava Mammals); Prinsep, J. (Tertiary Mammals); Rivett-Carnac, H. (Archegosaurus from Bijori); Royle, (Siwalik Mammals); Sim, Lieut. (Archegosaurus from Bijori); Smith, Capt. E. (Jamna Mammals); Strachev. Genl. (Tibet Tertiary Mammals); Trail, Dr. (Tibet Tertiary Mammals); and Verchere, Dr. (Siwalik Mammals).

The extinct vertebrate fauna of India, with the noticeable exception of the mammalian upper Tertiary fauna, is generally remarkable for its extreme poverty; a poverty which may be due in some cases to the want of adequate research, and in others to the small number of fossils preserved in the different strata. Only here and there, in the great Gondwana series of India—which, as far as regards its higher and fossiliferous part, in serial position, in mineralogical composition, and in its fresh-water character, seems to correspond very closely with the Trias-Jura of the Connecticut valley in America,—do we find fossils locally abundant, as the reptiles of the Panchet group, and the fish and reptiles of the Kota-Maleri and neighbouring groups. With the exception of a few Cretaceous reptiles, the fossils from the above-mentioned groups, which are really very few, are the only representatives of the Pre-Tertiary land and fresh-water vertebrate fauna of which we have any traces in India.

In place of the numerous and gigantic dinosaurs of the secondary lands of Europe and America, we have in India only here and there a few bones.

indicating the former existence of a small number of species; while of the more specialized and bird-like dinosaurs of those countries, we have as yet no trace in India; neither of the toothed birds, which present so remarkable a feature in the secondary epoch of America, are there any vestiges in India. The numerous species of the volant and toothed pterodactyls of Europe, and of their toothless representatives in America, are also totally unknown from Indian strata.

Of the gigantic estuarine or marine saurians, so characteristic of the secondaries of Europe and America, Indian strata have hitherto only yielded a few remains of a single *Ichthyosaurus* and *Plesiosaurus*. Of the lower batrachians, only a few species are known from the (probably) Triassic rocks of India, and the great number of species so characteristic of the Carboniferous and Trias of Europe are almost totally unrepresented in this country. The marine fish fauna is likewise remarkable for its general poverty.

It must, however, be observed that many of the vertebrates which do occur are only known by a single skull, or a tooth, or a few bones or scutes, and it, therefore, seems probable that many other species must have left similarly scattered remains through the strata of India, which from their extremely local distribution have hitherto escaped detection.

No distinctly recognizable traces of mammals have been as yet detected in India below the Nummulitic rocks, and in the latter only by a few generically undeterminable bones; indeed, we meet with no well-developed mammalian fauna till the period of the Upper Miocene and Lower Pliocene, when we suddenly come upon the evidence of the former existence of a vast and varied fauna which is, probably as numerically abundant in its species and genera as any known fossil fauna in the world. Previous to the Tertiary, the whole history of mammalian life in India is a complete blank. The bird-fauna of India, with a few exceptions, is almost totally unknown previously to the present epoch.

The above remarks have an important negative bearing on evolution. We know that the greater part of the peninsula of India has existed as land for an incalculable period of geological time,—at all events from the Triassic epoch, and we further know that in other regions mammals have existed on the globe since the Triassic, and birds since the Jurassic, period. As regards the above two groups of vertebrates, India throws not a single ray of light on their origin. We have not a trace of any one of the curious generalized forms of the Eocene mammals of North America in the strata of India, and yet we cannot think that ancient India was almost without mammalian life till the upper Miocene. It is indeed probable that the lost

 Marine recks are absent over most parts of peninsular India, though present in force in Trichinopoli, Kach, Sind, and the Himalaya. mammals of Secondary and early Tertiary India may have filled many a puzzling gap in the animal series.

It is the same with the reptiles, which were doubtless the dominant forms during the epoch of the Trias-Jura, and which have only here and there left a trace of their former existence in this country. Why may not many forms of those half-birds, half-reptiles have inhabited Secondary India of whose existence we have ample proofs in other countries; and why may not many of such Indian forms have still more closely bridged the gap which even yet exists between birds and reptiles? Great and numerous as are the advancements in uniting the scattered links of the broken chain of vertebrate evolution, it must ever be borne in mind that, while we have evidence of a large Secondary land-surface like India, which has hitherto yielded scarcely any links to this wondrous chain; we must never despair if we find that other countries are still of themselves unable to make the chain extend across all the gaps, owing to the want of a few links. Who shall say that such missing links never inhabited Secondary India, where their remains either still lie buried, or have been for ever lost beyond recovery? I, indeed, imagine that early India must have teemed with reptiles, and perhaps with higher forms of life, for it is inconceivable that this country was once mainly a mere forest of plants, of the existence of which we have such ample evidence in the Trias-Jura, unenlivened, except in one or two small spots, by vertebrate life.

I now proceed to sketch what is known of the fossil vertebrates of India, commencing with the lowest class, and tracing it through the various formations from the lowest in which it occurs to the highest; and similarly with the higher classes. I must premise that very many of the Indian fossil vertebrates are only known by extremely scanty remains, and that their affinities are consequently obscure. Of others, again, only very slight preliminary descriptions, without figures, have yet been published, and consequently foreign palæontologists have not yet had the opportunity of comparing them with other species, by which their affinities might be more fully illustrated.

FOSSIL FISHES.

Carboniferous.—The earliest fishes of which we have at present any record in India are only known by some few teeth and fin-spines, collected by Dr. Waagen and Mr. Wynne of the Geological Survey, in the Salt-Range of the Punjáb, and described by the former writer in the 'Palæontologia Indica.'* These fish remains were obtained from strata termed by Dr. Waagen the "Productus-Limestone," corresponding in the main to the Carboniferous. Signodus dubius is a fish belonging to a new genus founded upon a single tooth; this tooth is of an elongated conical form, and much resem-

[•] Ser. XIII, parts 1 and 2, 1879-80; the latter part in the press.

bles the teeth of some saurians; it is referred by Dr. Waagen to the ganoids. Another tooth, referred provisionally by Dr. Waagen to the genus Poecilodus, under the name of P. paradoxus, is of the flattened cestraciont type. Psephodus indicus is a species formed upon the evidence of another tooth. Both these genera belong to the Cochliodontida, which Dr. Waagen classes among the Dipnoi, though they are more generally referred to the Elasmobranchii. Of the undoubted Elasmobranchii (Selachii), Dr. Waagen describes four species, belonging to three genera, from teeth, and four species, belonging to two genera, from fin-spines (ichthyodorulites). the teeth, two are referred to a genus (Helodopsis) allied to Helodus. under the names of H. elongata and H. abbreviata. A fragment of a tooth is referred, without specific determination, to the European genus Psammodus, characteristic of the Carboniferous. A fourth tooth is referred to the European genus Petalorhyncus, with the specific name of P. indicus: it is extremely doubtful whether Petalorhunchus is really distinct from Petalodus of the Carboniferous. Of the spines, or "ichthyodorulites." three specimens are referred to the American Carboniferous genus Xystracanthus, under the names of X. gracilis and X. major and X. gigan-If I rightly understand Dr. Waagen's notes, he thinks it possible that these spines may belong to Helodopsis. A third spine is referred to a new genus under the name of Thaumatacanthus blanfordi.

As far as the evidence of these fishes goes, we find that the cestraciont-toothed sharks were the dominant forms in the Indian, as well as in the European and American Carboniferous.

Trias-Jura.—In the upper part of the great Gondwana system of India, which, as I have said, probably corresponds as a whole to the Trias-Jura of other countries, remains of fishes have been found in some abundance, all of which, as far as determined, are of fresh-water types, and belong to the Ganoidei and Dipnoi, no traces of the more modern Teleostei having yet been found in these rocks. The earliest groups of rocks in the Gondwana system in which fish remains have been detected are the Mangli and Sripermatur groups; but these remains have not yet been even generically identified. In the Kota-Maleri* group there occur nine species of Ganoids and three of Dipnoi; the former from the Kota beds have been described under the genera Dapedius, Lepidotus, and Tetragonolepis by Messrs. Egerton and Sykes; † many of them show Liassic affinities: the three genera

[•] Mr. King has lately shown a distinction between the Kota and Maleri beds; confirming the original distinction as to the Liassic affinities of the fossils of the former, and the Rhæto-triassic of those of the latter.

[†] Quar. Jour. Geol. Soc. of London, Vols. VII, IX, X. Palæontologia Indica, Ser. IV, part 2.

have a united range in Europe from the Lias to the Eocene: Lepidotus is very characteristic of the Wealden of England. Of the Maleri Dipnoi, teeth of four species of the living Queensland genus Ceratodus were named by the late Dr. Oldham, three of which have lately been figured by Professor Miall, who does not admit the fourth species, C. oblongus.

Cretaceous. - A few fish-remains have been obtained from the Lameta rocks (of middle Cretaceous age), but are not yet determined. The next group of rocks in which fish-remains have been obtained are the upper and middle Cretaceous rocks of Trichinopoli: these remains have been described by the late Dr. Stoliczka+ and Sir Philip Egerton. 1 They comprehend seventeen species of elas nobranchs, ranged under the genera Corax, Enchodus, Lamas, Odontaspis, Otodus, Oxyrhina, Ptychodus, and Sphærodus, and one ganoid doubtfully referred to Pycnodus. No Teleostei have been described, which is very probably owing to the less facility with which their remains are preserved; it being almost certain that they must have been represented in the Indian Cretaceous seas. The above-named genera are mainly characteristic of the Cretaceous rocks of Europe: two species are common to Europe and India. Bones, apparently of fishes, have been lately obtained by Mr. Griesbach from the Trias of Tibet. Mr. Griesbach tells me that these bones are not uncommon in the Trias limestone, but that he has not yet been able to extract any specimens in a determinable condition.

Eccene.—From the probably Nummulitic rocks of Port Blair, in the Andamans, and Rámri Island, off the Arakan coast, there have been obtained the oral teeth of a large species of Diodon, which I have lately provisionally called Diodon foleyi, after Captain Foley, the discoverer of the Rámri Island specimen. § The living Diodon hystrix is now abundant off the coasts of the Andamans and Arakán, where the genus has doubtless lived since the Eccene. From Nummulitic rocks in the neighbourhood of Thyatmyo, cycloid fish-scales have been obtained, but are not generically determined.

From the Nummulitics of the Punjáb, some fish-scales and the dental plate of a species of ray (Myliobatis) have been obtained by Mr. Wynne.¶ From strata immediately overlying the Nummulitics of Kohát, Mr. Wynne has obtained the incisor of a sparoid fish belonging to the genus Capitodus, which has been recently described by myself as C. indicus;** the genus

- Palæontologia Indica, Ser. IV, part 2.
- + Ibid., Cretaceous Fauna of S. India, Vol. IV.
- ‡ Quar. Jour. Geol. Soc. Lon. Vol. VII.
- § R. G. S. I. Vol. XIII, part I.
- Manual of Geology of India, p. 716.
- ¶ R. G. S. I. Vol. X, p. 43.
- ** Ibid. Vol. XIII, part I.

Capitodus was previously only known from the Miocene of Vienna and Silesia, and is allied to the living genus Sargus.

Mio-Pliocene.—From the Siwalik rocks there were, I believe, a considerable number of fish-remains procured by Falconer and Cautley, but these were never described: the collection of fossil fish-remains from the Siwaliks in the Indian Museum is but small. Among the Teleostei, we have the siluroids represented by a very perfect skull, originally described in the Society's Journal* by Dr. Cantor as the skull of a huge frog: subsequently this skull was referred by M'Clelland+ to the siluroid fishes. The latter writer describes the skull as being remarkable for its great breadth, and as carrying teeth on the jaws, but not on the palate: M'Clelland also thought that the skull might belong to a species of Pimelodus: this determination is, I think, certainly erroneous, because the latter genus, with one African exception, is entirely West Indian, and it is unlikely that a fresh-water genus of fishes should be found in the Pliocene of India, and now only in Africa and the West Indies. Many of the living Indian siluroids (Clarius, Heterobranchus, Silurus, Silurichthys) have palatal teeth, and the fossil cannot, therefore, belong to any of those genera. The Indian genus Chaca, on the other hand, is characterized, according to Dr. Günther, 1 by its exceedingly broad and depressed head, and absence of palatal teeth, and I think, therefore, it is not improbable that the fossil may belong to that genus, though, in the absence of specimens for comparison, I cannot be sure. Detached vertebræ, from the Siwaliks, also indicate the existence of teleostean and, probably, fresh water fishes, but of what group is uncertain. Of the Elasmobranchii, a few teeth indicate the former existence of a Siwalik Lamna, which probably inhabited the larger rivers: a single tooth from the mammaliferous beds of the Irawadi belongs to a species of Carcharias, and large squaline vertebra have been obtained from Perim Island. From the Siwaliks of Sind and the Punjáb, we have some crushing palatal teeth of an undescribed fish, which I have lately sent home for determination.

Scales of teleostean fishes have been obtained by Col. Godwin-Austen from the Tertiaries or post-Tertiaries of Kashmir; they are not, however, determined.

The above notes indicate the extreme poverty of the fossil fish-fauna of India—a poverty, I think, in great part due to the want of sufficient search.

[•] Vol. VI, p. 583.

[†] Calc. Jour. Nat. Hist. Vol. IV, p. 83.

² Brit. Mus. Cat. of Fishes, Vol. V, p. 29.

FOSSIL BATRACHIANS.

Trias-Jura.—We now come to the history of the fossil Batrachia (Amphibia), where we shall find an equal poverty of species and genera; such as are known being merely, in all probability, a few relics left from a large The oldest Indian batrachians, like their European and American contemporaries, belong to the labyrinthodont order, characterized by the peculiarly infolded structure of their teeth. The oldest form of the order in India is only known from an undescribed skeleton obtained from a group of the Gondwana system at Bijori, hence named by Mr. Medlicott the Bijori group.* This skull was originally exhibited before our Society in 1864, and commented upon by Mr. H. F. Blanford, who thought that it should be referred either to Archegosaurus or Labyrinthodon, † adducing some evidence to shew that it belonged to the former genus. Subsequently, the specimen was alluded to as a true Archegosaurus by the late Dr. Oldham,! and still later by Mr. Medlicott § I cannot discover what has become of this most interesting fossil, which is certainly not in the collection of the Indian Museum, where it is only represented by a cast. Judging from this cast, I think it not improbable that the specimen really does belong to Archegosaurus: it much resembles a skull of that genus from the European Carboniferous figured by H. von Meyer. || The European species being from the Carboniferous rocks does not at all preclude the Indian species from being of Triassic age, since there is considerable difference in the range in time of the Pre-Tertiary land faunas and floras of the two countries; genera having very frequently survived to a later period in India than in Europe.

From the Panchet group of the Gondwánas, we have two labyrinthodonts, to which the generic names Pachygonia and Gonioglyptus have been applied by Professor Huxley; these genera are only known by fragmentary skulls and jaws; they were slender-jawed forms and allied to the labyrinthodonts of the Keuper. They are classed by Professor Miall in the group Euglypta with Mastodonsaurus and Capitosaurus. The fossils on which the two above-named Indian genera were founded are in the collection of the Indian Museum. From the nearly contemporaneous Mangli group, we have another labyrinthodont, Brachyops laticeps of Owen, also belonging to a genus otherwise unknown, and allied to European Jurassic, and African

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* M. G. S. I. Vol. X, p. 159, (art. II, 27.)
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⁺ J. A. S. B., Vol. XXXIII, p. 337.

[†] R. G. S. I. Vol. IV, p. 70.

[&]amp; Loc. cit.

Palæontographica, Vol. VI, pl. XI, fig. 5.

[¶] Pal. Ind. Ser. IV. part 1.

and Australian (probably) Triassic forms. The skull on which the genus is founded was described by Professor Owen.* The European Jurassic genus to which it is allied is *Rhinosaurus*, the African (Triassic?), *Micropholis*, and the Australian, *Bothriceps*; the genus seems to me to be also closely allied to *Tuditanus radiatus* of the American Carboniferous. *Brachyops* belongs to the short-jawed group of labyrinthodonts; and, with the first three above-mentioned genera, constitutes the group "Brachyopina" of Professor Miall. The skull of *Brachyops* is, I believe, in the collection of the Geological Society of London: it is represented by a plaster cast in the Indian Museum.

Tertiary.—From the Trias to the Tertiary is a long leap, but hitherto no batrachian remains have been found in India between these two formations. In the lower Tertiaries of the island of Bombay, there occur a large number of the remains of frogs belonging, apparently, to two species. The smaller of these two species was first described by Professor Owen† under the name of Rana pusilla; subsequently, however, Dr. Stoliczka,‡ from the absence of vomerine teeth and from the structure of the limbs, referred the species to the genus Oxyglossus, at the present time living in China and Siam, and, possibly, in India. A larger frog from the same beds, noticed by Professor Owen in the same paper, has not yet been generically determined. I believe that these Bombay frogs are the oldest representatives of the group.

FOSSIL REPTILES.

Trias-Jura.—The oldest members of the class Reptilia hitherto found in India belong to the orders Dinosauria and Dicynodontia (Anomodontia), and occur in the presumably Triassic rocks of Panchet near Rániganj, in the horizon known as the "Panchet group." The Dicynodon was originally described by Professor Huxley§ under the name of D. orientulis; additional remains have subsequently been described by myself, which show that this species belonged to the sub-genus Ptychognathus of Professor Owen. Other remains noticed in the latter memoir, seem to indicate the former existence of a second and larger species of Dicynodon. This group of reptiles seems, on the whole, to be characteristic of the Trias of India, Russia, and Africa. The dinosaur has been named Ankistrodon indicus by Professor Huxley, and is the only known representative of the

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• Q. J. G. S. L. Vol. XI, p. 37.
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⁺ Ibid. Vol. V, p. 173.

[†] M. G. S. I. Vol. VI, p. 387.

[&]amp; Pal. Ind. Ser. IV, Vol. I, part I.

[|] Ibid. part 3.

[¶] Loc. cit.

genus. The teeth of Ankistrodon, of which only two are known, have laterally compressed crowns, with serrated edges, like those of the dinesaurian Megalosaurus and the mammalian Machærodus, and are implanted in distinct sockets. The genus is allied to the Jurassic and Cretaceous Megalosaurus, and to various Triassic genera.

From the Denwa group of the Gondwána system, a large crocodilian scute has been obtained by Mr. Hughes,* which seems to belong to Professor Huxley's undescribed genus *Parasuchus*.

From the neighbouring Kota-Maleri group, we have the crocodilian Parasuchus and the lacertian Hyperodapedon. The genus Parasuchus has never been described, but only incidentally alluded to by Professor Huxley+; it was formed for the Kota-Maleri bones: it seems to have been closely allied to the Triassic Belodon and Stagonolepis. On labels attached to the bones of Parasuchus, now in the Indian Museum, there occurs the specific name of hislopii, in Professor Huxley's handwriting. Hyperodapedon; is closely allied to the living genus Hatteria (Sphenodon), represented by two species in the New Zealand Islands, and, according to Professor Huxley, to the Triassic Rhynchosaurus, though this is doubted by Professor Owen.

From the undoubtedly Jurassic rocks of Kach (Cachh), there has been obtained (Chári group) a vertebra which I think very probably belongs to Parasuchus, though I cannot be certain; and (Umia group) a fragment of a lower jaw of a Plesiosaurus, which I have named P. indicus: the specific affinities of the latter cannot be fully determined from the fragment.

Cretaceous.—From the Cretaceous rocks of India, we have, among the Dinosauria, a species of Megalosaurus, certainly from the Trichinopoli, and probably from the Lameta rocks (middle Cretaceous); this genus is only known in India by detached teeth; in Europe, it ranges from the Jurassic to the lower Cretaceous (Wealden). From the Lameta rocks, there have also been obtained the remains of another gigantic genus of dinosaur, allied to the Wealden Pelorosaurus and the Jurassic Cetiosaurus, which I have named, from the great size of the bones, Titanosaurus; ** from the evidence of the vertebræ, there appear to have been two species, T. indicus and T.

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* Pal. Ind. Ser. IV. part 3.
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⁺ Q. J. G. S. L. Vol. XXVI, p. 49, XXXI, p. 427.

¹ Ibid. XXV, p. 151.

[§] R. G. S. I. Vol. X, p. 35.

[|] Pal. Ind. Ser. IV, part 3.

I Ibid.

^{••} lbid.

blanfordi. Titanosaurus was a gigantic and, probably, land reptile, but whether bipedal or quadrupedal is not known. Remains of another, but much smaller, reptile have been also obtained by Mr. Hughes from the Lameta rocks; the remains are, however, not sufficient for generic determination, but I think it not impossible that they may have belonged to a dinosaur.

Of the Cretaceous Crocodilia, we only know of one species by some amphicoelian vertebra and scutes obtained by Mr. W. T. Blanford from the upper Cretaceous rocks of Sind.* As far as I can judge, from these imperfect remains, they appear to indicate an animal allied to Suchosaurus of the Wealden of England.

The Chelonia are only known to have existed in India during the Cretaceous period by the evidence of some broken plates, in the collection of the Indian Museum, obtained from the Lameta group, from the intra-Trappeans of Rajamahendri (Rajamundry), and from the upper Cretaceous rocks of Sind. These remains are in far too imperfect condition for even generic determination.

A large species of *Ichthyosaurus*, which I have called *I. indicus*,† is known solely by a few vertebræ collected by Mr. Foote in the middle Cretaceous rocks of Trichinopoli. *Ichthyosaurus*, in England, ranges from the Lias to the Chalk.

Eccene.—The only specifically known Eccene Indian reptile with which I am acquainted, has been referred by the late Dr. Gray‡ to the genus Hydraspis belonging to the family Emydidæ. The specimen on which the determination rests is a carapace, from the intra-Trappean rocks of Bombay, originally named by Mr. Carter Testudo leithii. The genus Hydraspis is now found living exclusively in Tropical America. From the Nummulities of the Punjáb, remains of Crocodilia have been obtained by Messrs. Theobald and Wynne, of the Geological Survey, but are not generically determined.

Mio-Pliocene and Pleistocene.—From the Mio-Pliocene Siwaliks and from the Pleistocene Narbadas, a considerable number of reptilian remains have been obtained, but, in many cases, have not yet been described. Remains of Crocodilia have been obtained in considerable numbers from the Sub-Himalayan Siwaliks and from the corresponding rocks of Burma, Perim Island, and Sind; and many of them have been named by Falconer. Of the genus Crocodilus, a Siwalik species has been identified with the living C. palustris (bombifrons, Gray). § Remains of a crocodilian have

- Pal. Ind. Ser. IV. part 3.
- + Ibid.
- 1 Ann. Mag. Nat. Hist. Ser. IV, Vol. VIII, p. 339.
- § Cat. Foss. Vert. A. S. B. p. 200. The cranium there named C. palaindicus seems to belong to C. palustris.

also been obtained from the Irawadi and the Narbada, but their specific determination is difficult. Of the genus Gharialis (Leptorhynchus), one Siwalik species has been identified with the living G. gangeticus; a gharial from the Manchhars of Sind also belongs to this species. Another long-jawed Siwalik crocodile with slender teeth has been named Gharialis leptodus; and another with much shorter jaws and teeth, G. crassidens; the latter has been obtained from the Siwaliks and from Sind.

Of the order Lacertilia, only one Siwalik representative is known, belonging to the genus *Varanus*, and named by Falconer *V. sivalensis.** This determination was made on the evidence of a distal extremity of the humerus, now in the British Museum.

The Ophidia are only known by some vertebræ, much like those of the genus *Python*, obtained from the Siwaliks of the Punjáb and Sind: these vertebræ have not yet been generically determined.

The Chelonia are known by a considerable number of Siwalik, and two Narbada, species. Of the land tortoises, we have, firstly, the gigantic extinct species, Colossochelys atlas of Falconer and Cautley, from the Siwaliks and the Irawadi. Falconer says that the fossil species is mainly distinguished from the living genus Testudo by the thickening of the anterior (episternal) portion of the plastron; this character was considered to be only of subgeneric value, and I think the species might well be named Testudo atlas. The length of the carapace, according to Falconer's restoration, is 12 feet 3 inches, and of the entire animal, with the head and tail extended, 22 feet. In addition to Colossochelys, there is good evidence of the former existence of other gigantic tortoises in the Siwalik period. In the Indian Museum, there are several specimens of the ankylosed episternals of tortoises belonging to two distinct species. These bones are as thick, but not so elongated, as the emsternals of Colossochelys; they have diverging but shorter extramities than in the latter genus. The animals to which these bones belonged must have been. I think, two-thirds as large as Colossochelys, and may not improbably have belonged to Testudo. A broken episternal indicates a third, but smaller species. A fourth species is indicated by three episternals. which are not bifurcated at their free extremities: these bones indicate The episternal bones, from their solidity, seem more a smaller animal frequently preserved than any others. A single carapace of a small tortoise in the Indian Museum, from the Siwaliks, seems to belong Among the hard-shelled emydine tortoises. to the genus Testudo. we have, from the Siwaliks, a species of Bellia described by Mr.

^{*} Pal. Mem. Vol. I, pl. XXXII, figs. 4-7.

Theobald* under the name of B. sivalensis. This species, according to Mr. Theobald, is very closely allied to B. crassicollis, which, according to the same writer, + inhabits Tenasserim, Siam, and Sumátra. living species (B. nuchalis) inhabits Jáva. Another carapace of a Siwalik emydine, in the Indian Museum, seems to belong to a second species of In labels on the casts of Siwalik fossils from the British Museum. a three-ridged carapace of an emydine bears the name of Emys hamiltonoides (Falc. and Caut.): this name was doubtless given from the resemblance of this carapace to that of the living Damonia (Emys) hamiltonii, now inhabiting Lower Bengál: the generic name of the fossil should probably be Damonia. An imperfect carapace, collected by Mr. Theobald in the Siwaliks of the Punjáb, and now in the collection of the Indian Museum, seems to belong to Emys proper. Mr. Theobald has lately described, 1 under the name of Cautleya annuliger, a gigantic Siwalik emydine, from the evidence of a single marginal bone; the genus is said to be distinguished from all other emydines by the cartilaginous, in place of osseous, union of the marginal with the adjoining bones. In the family Bataquridæ, Dr. Falconer determined the identity of a Siwalik emydine with Pangshura (Emys) tectum of Bell§; subsequently, the species was shown by Dr. Stoliczkaji to occur in the newer Narbada deposits also: Pangshura tectum now inhabits Lower Bengál. Of the genus Bataque, a part of a plastron from the Narbada has been thought by Dr. Stoliczka¶ to belong very probably to B. dhongoka, now found living in the Narbada. Remains of a large Batagur, from the Siwaliks, are contained in the collection of the Indian Museum, but have not yet been specifically determined. A small carapace, with a ridge on the vertebral plates, lately presented by the Rúrki Museum to the Indian Museum, very probably belongs also to Batagur. Of the soft-shelled river-tortoises, a Trionyx from the Narbada has been thought by Dr. Stoliczka** to be not improbably identical with the living T. gangeticus. Plates of an undetermined Trionyx have been obtained in considerable numbers from the Sub-Himalayan Siwaliks, and from those of Burma and Perim Island. A carapace of an Emyda in the British Museum, from the Siwaliks, has been identified by Dr. Gray with the living Emyda vittata (coylonensis, Gray). This species, according to Mr. Theobald, inha-

^{*} R. G. S. I. Vol. X, p. 43.

[†] Catalogue of Reptiles of India, p. 10.

[‡] R. G. S. I. Vol. XII, p. 186.

[§] Pal. Mem. Vol. I, p. 382.

R. G. S. I. Vol II, p. 39.

[¶] Loc. cit.

^{**} Loc. cit.

bits Central and Southern India and Ceylon. In the Indian Museum there are numerous remains of *Emyda* from the Siwaliks of the Punjáb, Burma, and Perim Island, which may or may not belong to the last-named species.

General Remarks.—The foregoing notes will show that the fossil reptiles of India are noticeable for the extreme paucity of species known, and for the fragmentary remains of the known species. The Mesozoic Reptilia belong, as far as described, to extinct genera: the one known Eocene reptile (Hydraspis) belongs to a living genus, but one which is now far removed from India. The Siwalik (Mio-Pliocene) reptiles appear in great part to belong to living Indian genera, and in many cases to living species; the modern representatives are, however, in most cases, found no longer in the Sub-Himalayan disticts, but are now confined to Southern India. The Narbada fossil reptiles, in all probability, belong altogether to living species, and probably to species inhabiting the same district.

FOSSIL BIRDS.

Mio-Pliocene.—Fossil remains of birds have hitherto been found in India only in the Sub-Himalayan Siwaliks, and there only in comparatively small numbers. Some of their remains are in the Indian Museum, and have been partly described by myself,* while others are in the British Museum, and have been lately described by Mr. Davies. + Among the carinate birds, a tarso-metatarsus is considered by Mr. Davies to belong to a cormorant, possibly of the genus Graculus. A species of pelican (Pelecanus cautleyi) is indicated by a fragment of an ulna; this bird, according to Mr. Davies, must have been somewhat smaller than the living Indian P. mitratus. Another part of an ulna has been referred to a new species (Pelecanus sivalensis) by Mr. Davies, with a reservation as to the generic determination. A gigantic wader has been described by myself, under the name of Megaloscelornis sivalensis, from the evidence of a sternum and tibiotarsus. A distal extremity of a large bird humerus in the Indian Museum, collected by Mr. Fedden in Sind, has a diameter of 2 inches across the condyles: I cannot at present identify this bone with the humerus of any living genus of bird: from its size it might belong to Megaloscelornis; it makes some approach to the humerus of Ploteus. species of adjutant has been named by Milne-Edwards Argala falconeri. §

^{*} R. G. S. I. Vol. XII, p. 52.

[†] Geol. Mag. January 1880, p. 18.

¹ This bone was doubtfully referred by M. Edwards to Phaëton.

[§] The bone in the British Museum referred to by myself on page 56 of the above quoted paper belongs to this species.

There are also two small undetermined bird bones in the Indian Museum. The Struthioid or Ratitian modification of bird structure appears to have been represented by three Siwalik species; viz., an ostrich (Struthio asiaticus) indicated by some of the bones of the lower leg and foot and by vertebra: an emeu (Dromæus sivalensis), by bones of the foot: and, according to Mr. Davies, a three-toed bird, intermediate between these two genera, by a single phalangeal bone. The living ostrich is confined to the African continent, and the emeu to New-Holland; the occurrence of fossil species of these genera in the higher Tertiaries of India, probably points to a late land connection between these countries.

FOSSIL MAMMALS.

Eccene.—No traces of mammals have hitherto been detected in India below the Eccene, and in the latter formation only some fragmentary bones have been obtained by Mr. Wynne in the Nummulitics of the Punjáb. The only determinable bones consist of the distal portion of the femur and metatarsals of a probably perissodactyle animal, and the astragalus of an artiodactyle.* The femur was obtained from the Nummulitic (Subáthú) zone of the Punjáb, while the astragalus was obtained immediately above the Nummulitic clays of Fatchjang in the Punjáb, which are probably of upper Eccene age. The astragalus seems certainly to be that of a ruminant, as it belonged to an animal in which the navicular and cuboid bones were united. If this determination be correct, ruminants existed in the upper Eccene period.

Mio-Pliocene.—The Tertiary ossiferous rocks of Perim Island, Sind, the Punjab, the Sub-Himalayan Siwaliks, Sylhet, Tibet, and the valley of the Irawadi, have yielded a large number of mammalian and other vertebrate fossils, many of which are represented in the collection of the Society, now transferred to the Indian Museum. The fossils of the Irawadi valley were first brought to notice by Crawfurd and Clift, while those of the typical Siwaliks were rendered classic by the labours of Falconer and Cautley, and other former members of this Society. Some of these fossiliferous beds are of Miocene, and others of Pliocene age, and an admirable resumé of their distribution and relations are given in the 'Manual of the Geology of India,' to which work I must refer my readers desirous of further information on this subject.

The Siwalik Primates are at present known merely by a few fragments of upper and lower jaws and teeth, and it is probable that more species remain to be discovered. The known forms comprehend a large anthropoid ape, which has been named Palæopithecus sivalensis; † this

[•] R. G. S. I. Vol. IX, p. 92. In that passage the words "mammaliferous clays," should be "nummuliferous clays."

⁺ R. G. S. I. Vol. XII, p. 38.

species is known by the palate of a female and the canine of a male, and seems to have been allied to the living orang of Borneo, but is distinguished by the form of its premolars; two species of (probably) Semnopithecus and two of Macacus* have also been determined.

Among the Carnivora, we have a large tiger (Felis cristata) + characterized by its large sagittal crest; a second species has lately been described by Mr. P. N. Bose under the name of F. grandicristata, 1 with a still larger crest; while a third and much smaller species is indicated by a lower jaw in the Indian Museum. Of the genus Machairodus (Macharodus). there is M. sivalensis of Falconer and Cautley, said by Mr. Bose to be equal in size to the jaguar, and a larger species described by the same writer under the name of M. palæindicus. The genus Pseudælurus, distinguished from Felis by the presence of an additional lower premolar, is known by one lower jaw, which I have referred to a new species under the name of P. sivalensis. Among the civet-like animals, we have Viverra bakeri of Mr. Bose, said to be closely allied to the living civet, and Ictitherium sivalense described by myself from a lower jaw. || The hyzenas are represented by Hyena sivalensis of Falconer and Cautley, said by Mr. Bose to present relationship both to the Indian H. striata and the African H. crocuta; and H. felina of Mr. Bose, distinguished by the absence of the first upper premolar. The dogs, according to the same writer, are represented by two species of Canis (C. curvipalatus and C. cautleyi), the latter closely allied to the wolf; there is a specimen of the palate of a Canis in the Indian Museum, but I am at present unable to say whether it belongs to either of the above species. The genus Amphicyon, distinguished from Canis by the presence of an additional upper molar, is represented by A. palæindicus, Tremains of which have been obtained from Sind and the Punjáb. The bears are known by a single undescribed cranium of Ursus in the Indian Museum, and by the remarkable genus Huanarctos, of which two species are known: H. sivalensis ** was the original species on which the genus was founded, and has the upper molars with quadrangular crowns; a tooth apparently belonging to this species has been described by Professor Flower from the newer Pliocene (Red Crag) of

^{*} R. G. S. I. Vol. XIL p. 92.

⁺ Pal. Mem. Vol. I, p. 315. In manuscript the name of Felis palæotigris occurs.

[‡] Of this and five other species of Siwalik Carnivora, described by the same writer, I have only seen the notice given in 'Nature,' Jan. 1st, 1880.

[§] R. G. S. I. Vol. X, p. 83.

[|] Ibid. p. 32.

T Pal. Ind. Ser. X, Vol. I, p. 84. Megalotis (Otocyon) normally agrees with Amphicyon in having three upper true molars: it may, however, according to Prof. Flower, have four of these teeth.

^{••} F. A. S. pl. O.

England: the second species, named by myself H. palaindicus,* is known only by an upper jaw, not yet figured; the upper molars of this species have triangularly shaped crowns, somewhat like those of Amphicyon. Of the subursoid Carnivora, we have the living Indian and African genus Mellivora, represented by M. sivalensis,† apparently very closely allied to the living Indian species. A species of badger (Meles) is indicated by one lower jaw collected by Mr. Theobald.‡ Of the otters, one species of Lutra (L. palaindica) has been named by Falconer and Cautley from a skull and lower jaw§; another lower jaw in the Indian Museum, collected by Mr. Theobald, not improbably belongs to a second Siwalik species. Enhydriodon|| is a genus peculiar to the Siwaliks, and is allied to the living sea-otter (Enhydris) now inhabiting the shores of the North Pacific; the Siwalik genus was not improbably a river-dwelling form.

Of the Proboscidia, now represented only by the Indian and African elephants, there were a large number of Siwalik species, belonging to the genera Elephas, Mastodon, and Dinotherium. Of the first-named genus, there were three sub-genera living in Siwalik times, viz., Euclephas, Loxodon, and Stegodon. Euclephas was represented by E. hysudricus, provided with simpler molars than the living representative of the sub-genus; Loxodon was represented by L. planifrons, remarkable for being the only species of elephant in which premolars are known to have been developed. The subgenus Stegodon is peculiar to South-Eastern Asia, and was represented by four species in the Sub-Himalavan and other Indian Siwaliks: these species are named S. ganesa, S. insignis, S. bombifrons, and S. cliftii. The molars of the two first are more complex than those of either of the other two. and are indistinguishable from each other; the skull of the first species is distinguished by its enormously developed tusks. The intermediate molars of S. cliftii have not more than six ridges each. From (probably) Pliocene deposits in China, two stegodons have been described by Professor Owen under the names of S. sinensis and S. orientalis, which appear to be respectively the same as S. cliftii and S. insignis. Tof the mastodons, five species, M. sivalensis, M. latidens, M. perimensis, M. pandionis, and M. falconeri, have been described from the Mio-Pliocene of India: the three first-named species belong to the tetralophodont, and the two last to the trilophodont, sub-division of the genus: the two first-named species have a tendency to a pentalophodont molar formula. Of the European

^{*} R. G. S. I. Vol. XI, p. 103.

⁺ Ibid. p. 102: named in 'F. A. S.' Ursitaxus.

[†] R. G. S. I. Vol. XI, p. 102.

[§] F. A. S. supl. pl. Pl.

[|] Ibid.

[¶] Pal, Ind. Ser. X. Vol. I. pt. 5 (in the press.)

Miocene genus Dinotherium, three species, D. indicum, D. pentapotamia, and D. sindiense, have been described from the Indian Mio-Pliocene: the last species presents a remarkable approximation to the mastodons in the form of its mandible.*

The perissodactyle modification of the great order Ungulata is well represented, both in genera and species, in the Indian Mio-Pliocene. Of Rhinoceros there are four named species, R. iravadicus, R. sivalensis, R. palæindicus, and R. platyrhinus; + the molars of the two first are constructed on the type of those of R. sumatrensis; those of the last on the type of those of R. indicus; R. sivalensis and R. palæindicus were unicorn, and R. platurhinus was bicorn. Bones of one species have also been obtained from Tibet. The hornless rhinoceroses were represented by Acerotherium perimense, of which there is a fine undescribed skull from the Punjáb in the Indian Museum. 1 It is doubtful if the genus Tapirus is represented in the fossil state in India; a symphysis of a mandible has been figured in the second volume of the second series of the 'Transactions of the Geological Society of London' by the late Mr. Clift, and referred to Tapirus, but I think the determination is at least open to doubt. Molars of Listriodon were described in MSS. by Falconer under the name of Tapirus and so published in the 'Palæontological Memoirs.' The genus Listriodon | is represented by two species, L. pentapotamic and The genus Chalicotherium is represented by one species (C. sivalense), T presenting some peculiar points in its dentition: this genus has till lately been classed with Anoplotherium among the Artiodactyla, but Professor Cope has lately come to the conclusion that it is a perissodactyle allied to Palaeotherium. The horses are represented by the genera Equus and Hippotherium (Hipparion). Equus is known by a Siwalik species (E. sivalensis), ** never fully described, and by one from the Tibetan

- For figures and descriptions of the Indian fossil Proboscidia, see F. A. S. and Pal. Ind. Scr. X, Vol. I, pt. 5 (in the press): a jaw of *D. pentapotamiæ* was described as *Antoletherium* by Falconer.
 - + F. A. S. and Pal. Ind. Ser. X, Vol. I.
- ‡ Some molars of this species were described by myself under the name of *Rhinoceros planidens*. R. Sivalensis has lately been made the type of a new genus Zalabis by Prof. Cope, but on insufficient grounds.
 - § Vol. I, p. 415.
- || Pal. Ind. Ser. X, Vol. I. and R. G. S. I. Vol. XI, p. 98 I have followed Professor Cope in classing this genus with the tapirs; Kowalewsky was inclined to place it among the artiodactyles.
 - ¶ Pal. Mem. Vol. I, pl. XVII.
- •• Professor Huxley (Q. J. G. S. L. 1870, Presid. Address) remarks that some of the Siwalik horses show traces of a "larmial" cavity on the skull. I do not know whether this remark applies to the Siwalik or Narbada horse, but probably the former as the older.

Tertiaries: of Hippotherium, there are two Siwalik species, H. antilopinum and H. theobaldi*: remains of the genus have also been obtained from Tibet. M. Gaudry remarks† that the Siwalik Hippotheria have no lateral digits; this may possibly be the case with H. antilopinum, but it is certainly not so with the larger H. theobaldi, of which there is a nearly complete tridactyle foot in the Indian Museum. H. theobaldi has not yet been fully described; it is very like H. gracile, to which species some Siwalik molars were referred by H. von Meyer‡ under the name of Equus primigenius.

Of the artiodactyle modification of the Ungulata, there is a still longer list in the Indian Mio-Pliocene. In the bunodont sub-division, we have Hippopotamus represented by two species (H. iravadicus and H. sivalensis), both belonging to the hexaprotodont sub-genus. A Siwalik bunodont (Tetraconodon magnum) & is noticeable for its enormous conical premolars: this genus is probably related to Entelodon (Elotherium) of the Tertiaries of Europe and America. The true pigs (Sus) are represented by three species, S. giganteus, S. hysudricus, and S. punjabiensis; the two former were named by Falconer and Cautley, while the last name was applied Sanitherium is a small suine animal, only known by the lower by myself. molars. Hippohyus is a genus of suine animals whose molars present a peculiar complexity of pattern, recalling that of the molars of the horse; the genus is peculiar to the Siwaliks, where it appears to have been represented by two species. The European Miocene genus Hyotherium is represented in the Tertiaries of Sind and Perim Island by a species which I have provisionally named H. sindiense. ** Of the suine animals with selenodont teeth, we have, among the forms with five cusps on the molars, a species of Anthracotherium (A. silistrense)++ from Sind, the Punjáb, and Sylhet, and a species of Hyopotamus (H. sindiense) 11 from Sind; among the forms characterized by having only four cusps on the molars, we have four genera, Merycopotamus, Chæromeryx, Hemimeryx, and Sivameryx, § all peculiar to the Sind and Punjáb Siwaliks, and each known only by a single species: || || the two last genera are at present undescribed.

- Milk-molars of this species were at first referred to a new genus, Sivalhippus, by myself (R. G. S. I. vol. X. pp. 31. 82).
 - + "Animaux Fossiles and Geologie dè l'Attique" p. 231.
 - † Palæontographica, Vol. XV, p. 17.
 - § Pal. Ind. Ser. X, Vol. I.
- R. G. S. I. Vol. XI, p. 81. A suine animal has been named by myself *Hippo-potamodon*, but I am now not certain of its generic distinctness.
 - ¶ Ibid. p. 82. ** Ibid p. 77.
 - ++ Ibid. p. 78, a jaw of this species was described by me as A. punjabiense.
 - 11 Ibid, Vol. X, p. 77. §§ Ibid. Vol. XI, pp. 78, 80.
- ||| Falconer in a MS. note described some teeth of Dorcatherium, under the name of Merycopotamus nanus. (Pal. Ind. Ser. X, Vol. I.)

Among the true ruminants, we have the deer family represented by several species of Cervus, namely, C. triplidens, C. simplicidens, and C. latidens; the genus of the last being somewhat doubtful. A fourth undescribed species has been named C. sivalensis.* The genus Dorcatherium is represented by the two species, D. majus and D. minus. † At least one of the Siwalik deer had branching antlers with a flattened beam, somewhat like those of the living C. duvaucellii. Cervus triplidens had a large accessary column in the molars, while C. simplicidens was a species as large as the Káshmir stag, with a much smaller accessory molar column. A single molar in the Indian Museum seems to indicate a Siwalik representative of the genus Palacomeryx. The giraffes were represented in India by probably two species, one of which has been named Camelopardalis sivaleneis. 1 Of the family Sivatheriide, which, with the exception of Helladotherium from the Pikermi beds of Attica, is peculiar to India, we have four genera in the Mio-Pliocene. Hydaspitherium is represented by probably three species, H. megacephalum known by the skull, which carried a massive conjoint horn-base above the occiput; and H. leptognathus and H. grande, by lower jaws and teeth. Bramatherium perimense is known by the skull, teeth, and jaws; this species seems to have carried a pair of horns over the occiput and a large conjoint horn-base on the fron-Vishnutherium iravadicum is at present only known definitely by a fragment of a lower jaw from Burma of much smaller size than any of the other genera: it is not impossible, however, that some nondescript upper molars, in the Indian Museum, from the Punjáb, may belong to this genus. Sivatherium qiqanteum was the first known of this group of animals, and was originally described in the Society's Journal | as a fossil elk: several skulls of this species are known; the male carried two pairs of horns. placed like those of the living Indian four-horned antelope (Tetraceros). while the female was hornless. An elaborate memoir on this interesting animal has been published by Dr. Murie. The molar teeth seem to be nearest to those of the giraffes, and also approach those of Cervus megaceros and Alces: Dr. Murie comes to the conclusion that the horns of Sivatherium were intermediate in structure between the antlers of deer and the horns of the true cavicorn ruminants, and that they probably

^{*} Pal. Ind. Ser. X, Vol. I, Preface (in the press).

⁺ Ibid.

[‡] Remains of this species were described under the names of *C. sivalensis* and *C. affinis* by Falconer. See R. G. S. I. Vol. XI, p. 83.

[§] Pal. Ind. Ser. X, Vol. I, R. G. S. I. Vol. XI, p. 90. M. Gaudry in his work, 'Les Enchainements du Monde Animal,' mentions that *Helladotherium* occurs in India: I am unacquainted on what grounds,

^{||} Vol. IV, p. 506.

[¶] Geol, Mag. Vol. VIII, p. 438,

carried a deciduous sheath like those of the living American prong-buck (Antilocapra). Of the antelopes, several species have been described, the largest of which (A. palaindica.)* is supposed to have presented affinities to some African forms; A. sivalensist is allied to the Indian blackbuck (A. cervicapra); while A. patulicornis and A. acuticornis do not appear to come close to any living forms. Other molar teeth belong to a species of Portax, now only represented by the living nilghai of India. Others again are like those of Palæoryx, a genus of antelopoid animals described from the Pikermi beds of Attica; this determination. owing to the absence of skulls and the great difficulty of precisely determining isolated ruminant teeth, is only provisional. The oxen are represented by five genera, among which Hemibos is represented by three species. H. occipitalis, H. acuticornis, and H. antilopinus: 1 this genus is peculiar to the Siwaliks, and connects the oxen and antelopes. Leptobos falconeri is another species of antelopoid oxen, known by some crania. The genus Bubalus is represented by Bubalus platyceros, a species with horns concave superiorly; and, in the highest Siwalik, by B. palaindicus, which is extremely close to the living wild buffalo of Assam. Of the genus Bison, there is only one species in the Siwaliks, which has been named B. sivalensis, and which seems to have been related to the extinct European B. priscus. Of the true oxen (Bos) there are three Siwalik species, namely, Bos acutifrons remarkable for its enormous horns and angulated forehead: B. planifrons with shorter horns and a flattened forehead, and allied to the gigantic Bos primigenius of Europe; and Bos platyrhinus only known by the lower half of a skull, and of which the generic affinities are doubtful. There seem to have been four species of goats in the Indian Tertiaries, most of which are probably of Pliocene age, viz., an unnamed species with horn-cores very like those of the Himalayan Capra falconeri (markhor), and two named species. C. sivalensis and C. perimensis, both of which are only known by frontlets and horn-cores: the fourth species has been described by Professor Rütimeyer under the name of Bucapra daviesis. No remains of the genus Ovis have hitherto been described from the Sub-Himalayan or other Indian Siwaliks, but a cranium obtained from the presumably Siwalik strata of Tibet has been referred by the late Mr. Blyth to this genus. The genus Camelus is known by C. sivalensis, which presents a pe-

[•] Pal. Mem. Vol. I, pl. 23.

[†] Pal. Ind. Ser. X, Vol. I. Two species (A. picta and A. gyricornis,) were named in MSS. by Falconer.

[†] These three species have been also described under the generic names of *Probu-balus*, *Amphibos*, and *Peribos*; the synonomy will be found in the first volume of the tenth series of the 'Palseontologia Indica,' where all the other Indian fossil ruminants are noticed. Part of this volume is still in the press.

culiarity in the lower molars, connecting it with the American auchenias, and distinguishing it from the other old-world camels.* The similarity of the lower molars of the Siwalik camel and Auchenia is very noteworthy, since America is supposed to have been the original home of the Camelida: this supposition is supported by the connection between the living American camels (Auchenia) and the Pliocene old-world camels.

The other orders of Mammalia are only represented by a few species of Rodentia and one of Edentata. Among the rodents, a rat (Mus) is mentioned by Falconer as a member of the Siwalik fauna. A species of bamboo-rat (Rhizomys sivalensis) † has been named by myself, from some lower jaws collected by Mr. Theobald in the Punjáb. A porcupine (Hystrix sivalensis) is known by a part of a cranium and a lower jaw.

The edentates are only known by one species of pangolin (Manis sindiensis), which has been named on the evidence of a solitary phalangeal bone from Sind. 1

The Mio-Plocene mammalian fauna of India, as a whole, is characterized by the great number of forms belonging to the orders including animals of large corporeal bulk, and also by the admixture of modern African and Miocene European genera with those now peculiar to India. The Proboscidia and the perissodactyle Ungulata, now so sparingly represented on the globe, were abundant in Mio-Pliocene India, and were probably the dominant forms: the ruminants have now diminished somewhat in numbers in several groups, but not to such a striking extent as the proboscidians. The selenodont hogs, like Merycopotamus and Anthracotherium, belong to a group which has completely passed away, while their congener the hippopotamus is now confined to Africa. Of the larger mammals now inhabiting India, nearly all are generically represented in the Pliocene, while forms, like Anoa (the living representative of Hemibos), inhabiting neighbouring countries seem to have descended from Indian ancestors. The micro-mammalia are practically unrepresented in the Mio-Pliceme, but this is probably due to the smaller chance of their remains being preserved in a fossilized condition, or, if so preserved, of being discovered.

PLEISTOCENE.

The mammals of the Pleistocene of India are as yet even less well known than those of the Mio-Pliocene, owing to the smaller areas in which

- A second species of Siwalik camel was named in MSS. C. antiques by Falcons.
 This species cannot now be identified.
- + For descriptions of this and other Siwalik rodents, see R. G. S. I. Vol. XI, p. 100. Rhizomys is probably the same as Typhlodon of Falconer.
 - † Pal. Ind. Ser. X, Vol. I,

they are found. It seems, however, even with our present knowledge, to be pretty safe to say that the numerical strength of species of the larger mammals so characteristic of the Mio-Pliocene had disappeared in the Pleistocene. From the older alluvium of the Jamna river, mammalian bones have been obtained in considerable quantities, but only two species have been satisfactorily determined; the remaining bones have only been generically named, and are, therefore, not referred to here, as it is in many cases impossible to say whether they belong to living or to extinct species. The presence of Hippopotamus remains in a stratum is pretty good evidence of such stratum being not newer than the Pleistocene. The discovery of a molar and canine of this genus in the alluvia of the Pemganga river, by Mr. Fedden, consequently shows that some of those deposits should be referred to the Pleistocene. In many cases, as in the delta of the Ganges, it is often most difficult, or impossible, to draw the line between the Pleistocene deposits and the Recent alluvium of the same area.

In the laterite of Madras, stone implements, and a human tibia have been found by Mr. Foote, and are assigned to the Pleistocene by Professor Boyd-Dawkins. Stone implements have likewise been obtained from the ossiferous beds of the Narbada valley, in association with the remains of extinct mammals. The mammalian fauna of the Narbada beds comprises. among the Carnivora, a species of bear (Ursus namadicus), named by the authors of the 'Fauna Antiqua Sivalensis' on the evidence of a portion of the maxilla with the molar dentition: this specimen is now in the British Museum, presented by Captain Frazer.* Among the Proboscidia, we have the extinct Euclephas namadicus, characterized by the extraordinary ridge on the forehead; the molars of this species are very like those of the European Elephas antiquus, from which Professor Leith Adams has thought that the Indian and European forms might belong to the same species. was represented by S. ganesa and, possibly, by S. insignis. Among the fossil perissodactyles of the Pleistocene, we have Rhinoceros deccanensist of Mr. Foote from the Deccan, a species without permanent lower incisors, and shewing African affinities; and from the Narbada the living R. indicus. remains of which were at first named R. namadicus. A third species (R. namadicus) probably also existed in the Pleistocene. The horses are represented by Equus namadicus, 1 as yet not fully described. Among

[•] F. A. S. plate O. I have elsewhere mentioned a species of *Felis* from the Nar-bada beds, the determination having been made on the evidence of the olecranal portion of an ulna in the old collection of the Geological Survey; the history of the specimen is, however, unknown, and from its mineral condition I am by no means sure that it is from the Narbada.

[†] Pal. Ind. Ser. X, Vol. I.

I Faun, Ant. Siv. E. palæonus seems to be the young of E. namadicus.

the artiodactyles, we find two species of Hippopotamus, one of which (H. namadicus) belongs to the hexaprotodont type, while the other (H. palaindicus) is tetraprotodont, like the larger living species;* H. palæindicus has also been found in the older alluvia of the Jamna. The pigs seem to have been represented by Sus giganteus. + A species of stag was named by Falconer Corvus namadicus, but never described; a single molar from the Narbada in the Indian Museum is indistinguishable from the corresponding tooth of the living C. (Rucervus) duvaucellii. Three species of Narbada oxen have been described, viz., Bos namadicus of Falconer and Cautley, a taurine ox showing some affinities to the living Asiatic genus Bibos, also occurring in the Pem-ganga alluvium and, possibly, in the Deccan; Bubalus palæindicus of the same authors, very closely allied to the living wild Indian buffalo, also found in the Jamna alluvium; and Leptobos frazeri of Professor Rüti-A species of nilghai (Portax) has lately been described by the same writer from the Narbada rocks, under the name of P. namadicus; teeth of the same genus have also been obtained from the Pem-ganga alluium.

The Pleistocene rodents are only represented by some incisors probably belonging to the genus *Mus*, obtained from the Narbada valley, and now in the Indian Museum.

RECENT.

The Recent deposits have not yet, as I have said, in many cases been satisfactorily separated from the Pleistocene, and the very local occurrence of mammalian bones renders this point of doubt one not likely to be soon cleared up. Any alluvial deposits of bones from which *Hippopotamus* is absent, and which do not contain any other extinct animals, I should be disposed to class as Recent.

Human remains have been obtained in the alluvium of the plains in various localities, at considerable distances below the surface, but generally in very imperfect condition. Specimens of the teeth and jaws of *Macacus rhesus* are exhibited in the Indian Museum, obtained from the alluvia of Assam and Madras; those from the former locality are in a highly mineralised condition. Molars of the Indian elephant have been obtained in the alluvium of the plains of India, and in that of the delta of the Irawadi. A last upper molar of *Rhinoceros indicus* has been obtained by Mr. Foote in the alluvium of Madras: this specimen is very interesting as shewing the former range of that species far to the south of its present habitat, which Jerdon gives as "the Terai from Bhotan to Nepal." Su

- The smaller Liberian hippopotamus (Charopsis) has only two lower incisors.
- † The authority for introducing this species in the Narbada fauna is the specimes drawn in plate LXX, fig. 8. of the F. A. S.

indicus has also been obtained by Mr. Foote in the same formation. Antilope cervicapra is represented by a fossil horn-core in the Indian Museum whose exact locality is uncertain. Antlers, horn-cores, and teeth of species of Bos and Cervus have been obtained from alluvia of various parts of the plains, and from raised beaches on the Kattiawar (Kattywar) coast; as, however, these specimens are not yet specifically determined, no more can be said about them.

LIST OF THE FOSSIL VERTEBRATA OF INDIA AND BURMA.

The following list exhibits in a systematic form all the well-established species of Indian and Burman fossil vertebrata, together with the best authenticated of the unnamed species with which I am acquainted. For the great divisions of geological times, the terms Anthropozoic (Age-of-Man), Theriozoic (Age-of-Mammals), Saurozoic (Age-of-Reptiles), and Ichthyozoic (Age-of-Fishes), have been employed in lieu of the old terms Post-Tertiary, Kainozoic, Mesozoic, and Palæozoic, as being more applicable to a chronology of vertebrate evolution, and as forming a series of symmetrical terms.

I. ANTHROPOZOIC (POST-TERTIARY).

1. RECENT ALLUVIA.

MAMMALIA. PRIMATES. Hor

Homo (sapiens?). Plains.

PROBOSCIDIA.

Macacus rhesus. Gúlpara and Madras. Euelephas indicus. India and Burma.

Ungulata.

Rhinoceros indicus. Madras.

Sus indicus. Madras.

Cervus. Kattiawar.

Antilope cervicapra. Ganges Valley. (?)

Bos. sp. Kattiawar and Plains.

REPTILIA. CHELONIA.

? (plates) Calcutta.

Other undetermined remains of, probably, recent species.

2. Pleistocene.

MAMMALIA. PRIMATES.

Homo. sp. Narbada (weapons) and Madras (weapons and bones).

CARNIVORA.

Ursus namadicus. (F. and C.) Narbada.

PROBOSCIDIA.

Euclephas namadicus. (F. and C.) Narbada.

Stegodon ganesa. (F. and C.) Narbada.

------- ? insignis. (F. and C.) Narbada.

? Mastodon pandionis. (Falc.) Deccan.

UNGULATA.

Rhinoceros deccanensis. (Foote.) Deccan.

——— indicus. (Cuv.) Narbada.

namadicus. (F. and C.) Narbada. Equus namadicus. (F. and C.) Narbada.

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MAMMALIA. UNGULATA.	Hippopotamus namadicus. (F. and C.) Narbada. ——————————————————————————————————
	Sus giganteus. (F. and C.) Narbada. Cervus sp (? duvancellii) (Narbada). Bubalus palæindicus (F. and C.) Narbada and J. Bos namadicus. (F. and C.) Narbada. P: G. and (?) Deccan.
	Leptobos frazeri. (Rüt.) Narbada.
D	Portax namadicus. (Rüt.) Narbada. and P: G.
RODENTIA.	Mus. sp. Narbada.
	Crocodilus (?) sp. Narbada.
CHELONIA.	Pangshura tectum. (Bell. sp.) Narbada.
	Batagur (? dhongoka) Narbada.
	Trionyx (? gangeticus.) Narbada.
II. TH	ERIOZOIC (KAINOZOIC.)
	1. PLIO-MIOCENE.
MAMMALIA. PRIMATES.	Palæopithecus sivalensis. (Lyd.) S.
	Macacus sivalensis. (Lyd.) S.
	sp. S.
	Semnopithecus subhimalayanus. (Myr.) S.
	sp. S.
CARNIVORA.	Felis cristata. (F. and C.) S.
	—— grandicristata. (Bose.) S.
	—— sp. S.
	Machairodus sivalensis. (F. and C.) S.
	palæindicus. (Bose) S.
	Pseudælurus sivalensis. (Lyd.) S.
	Ictitherium sivalense. (Lyd.) S.
	Viverra bakerii. (Bose.) S.
	Hyæna sivalensis. (F. and C.) S. felina. (Bose.) S.
	Canis curvipalatus. (Bose.) S.
	—— cautleyi. (Bose.) S.
	Amphicyon palæindicus. (Lyd.) S. Sd.
	Ursus. sp. S.
	sp. I.
	Hyænarctos sivalensis. (F. and C.) S. Sd.
	palæindicus. (Lyd.) S.
	Mellivora sivalensis. (F. and C.) S.
	Meles, sp. (Lyd.) S.

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MAMMALIA. CARNIVORA. Lutra palæindica. (F. and C.) S.
                          Enhydriodon sivalensis. (F. and C.) S.
            PROBOSCIDIA. Euclephas hysudricus. (F. and C.) S.
                          Loxodon planifrons. (F. and C.) S.
                          Stegodon ganesa. (F. and C.) S.
                                  insignis. (F. and C.) S.
                                  bombifrons.
                                               (F. and C.) S.
                                  cliftii.
                                          (F. and C.) S.
                          Mastodon sivalensis. (F. and U.) S.
                           latidens. (F. and C.) S. I. Sd. P.
                              —— perimensis. (F. and C.) S. Sd. P.
                              pandionis. (F.) Sd. S. P.
                             ——— falconeri. (Lyd.) Sd. S.
                         Dinotherium indicum. (Falc.) S. P.
                            pentapotamiæ. (Falc.) S.
                              --- sindiense.
                                             (Lvd.) Sd. S.
                         Chalicotherium sivalense. S. Sd.
            UNGULATA.
                         Rhinoceros iravadicus. (Lvd.) I.
                                   palæindicus. (F. and C.) S.
                                   platyrhinus. (F. and C.) S.
                                    sivalensis. (F. and C.) S. Sd.
                                        Tibet.
                                    sp.
                         Acerotherium perimense. (F. and C.) P.Sd.S.I.
                         Listriodon pentapotamiæ. (Falc. sp.)
                         theobaldi. (Lvd.) S.
                         (?) Tapirus, sp. (Clift.) I.
                         Equus sivalensis. (F. and C.) S.
                         ____ sp. Tibet.
                         Hippotherium antilopinum. (F. and C.) S.
                               - theobaldi. (Lyd.) P. S. Sd.
                                    sp. Tibet.
                         Hippopotamus iravadicus. (F. and C.) I.
                         sivalensis. (F. and C.) S.
                         Tetraconodon magnum. (Falc.) S.
                         Sus giganteus. (F. and C.) S.
                         - hysudricus. (F. and C.) S. P. Sd.
                         - punjabiensis. (Lyd.) S.
                         Hippohyus sivalensis. (F. and C.) S.
                                              S.
                         Sanitherium schlagintweitii (Myr.) S.
                         Hyotherium sindiense(Lyd.)Sd.
                         Anthracotherium silistrense. (Pent.) Sy. S. Sd.
                        (Lyd.) Sd.
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MAMMALIA. Ungulata.

Merycopotamus dissimilis. (F. and C.) 5.
Chæromeryx silistrensis. (Pom.) Sy.
Hemimeryx, sp. (Lyd.) Sd.
Sivameryx, sp. (Lyd.) Sd.
Cervus triplidens. (Lyd.) S.
——— sivalensis. (Lyd. Mss.) S.
simplicidens. (Lyd.) S.
——— (?) latidens. (Lyd.) S.
Dorcatherium majus. (Lyd.) S.
minus. (Lyd.) S.
Palæomeryx, sp. (Lyd.) S. Sd. (?)
Camelopardalis sivalensis. (F. and C.) S. P.
sp. S.
Hydaspitherium grande. (Lyd.) S.
leptognathus. (Lyd.) S.
megacephalum. (Lyd.) S.
Bramatherium perimense. (Falc.) P.
Sivatherium giganteum. (F. and C.) S.
Vishnutherium iravadicum (Lyd.) I. S. (?)
Antilope palæindica. (F. and C.) S.
patulicornis. (Lyd.) S.
porrecticornis. (Lyd.) S.
sivalensis. (Lyd.) S.
? Palæoryx, sp. (Lyd.) S.
Portax, sp. (Lyd.) S.
Hemibos occipitalis. (Falc. sp.) S.
acuticornis. (Falc. sp.) S.
antilopinus. (Falc. sp.) S.
Leptobos falconeri. (Rüt.) S.
Bubalus platyceros. (Lyd.) S. ———————————————————————————————————
Bison sivalensis. (Falc. MSS.) S.
Bos acutifrons. (Lyd.) S.
planifrons. (Lyd.) S.
platyrhinus. (Lyd.) S.
Program deriosii (Büt) S
Bucapra daviesii. (Rüt.) S.
Capra perimensis. (Lyd.) P. —— sivalensis. (Lyd.) S.
sp. (Lyd.) S.
2 Original (Plath) S. T
? Ovis, sp. (Blyth.) S. T. Camelus sivalensis. (F. and C.) S.
Camera sivalensis. (r. and c.) b.

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MAMMALIA. RODENTIA. Mus. sp. S.
                          Rhizomys sivalensis. (Lyd.) S.
                          Hystrix sivalensis.
                                              (Lyd.) S.
             EDENTATA.
                          Manis sindiensis.
                                             (Lyd.) Sd.
AVES.
              CARINATE.
                          Graculus (?), sp.
                                            (Dav.) S.
                          Pelecanus cautleyi. (Dav.) S.
                          ----- ? sivalensis.
                                                (Dav.) S.
                          Megaloscelornis sivalensis (Lyd.)
                          Megaloscelornis. (?) sp. Sd.
                          Argala falconeri (M. Ed.) S.
                          Struthio asiaticus. (M. Ed.) S.
                RATITÆ.
                          Dromæus sivalensis. (Lyd.) S.
                          Gen. indet. (Brit. Mus. Col.) S.
REPTILIA. CROCODILIA. Crocodilus palustris (Less.) S. P.
                                __ sp.
                                           T.
                          Gharialis gangeticus (Gmel.) S. Sd. I.
                          ---- leptodus (F. and C.) S.
                          ---- crassidens. (F. and C.) S. Sd.
             LACERTILIA. Varanus sivalensis. (Falc.) S.
                          Gen. indet. S. Sd.
             OPHIDIA.
                          Colossochelys atlas. (F. and C.)
             CHELONIA.
                          Testudo (?), 5 sp.
                          Bellia sivalensis. (Theo.) S.
                                                   S.
                          ---- вр.
                          Damonia hamiltonoides. (Falc. sp.) S.
                          Emys, sp. S.
                          Cautleya annuliger.
                                               (Theo.) S.
                          Pangshura tectum.
                                              (Bell. sp.) S.
                          Batagur, sp.
                          Trionyx, sp. S. I. P.
                          Emyda vittata. (Pet.) S.
                           ---- вр.
                                           S. I. P.
                          Carcharias, sp. I.
PISCES.
           ELASMO-
                          Lamna, sp. Sd.
             BRANCHIL.
                              ? (vertebræ.) P.
                             ? (palatal teeth) S. Sd.
                           Chaca (?), sp. S.
           TELEOSTRI.
                             ? (vertebræ.) S. Sd.
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2. EOCENE (INTRATRAPPEAN AND NUMMULITIC).

MAMMALIA. UNGULATA. (perissodactyle femur). Punjáb.

(artiodactyle astragalus) Punjáb.

REPTILIA.	CROCODILIA.	(teeth and vertebræ) Punjáb.
	CHELONIA.	Hydraspis leithii (Carter sp.) Bombay.
BATRACHIA	A. Anoura	Oxyglossus pusillus. (Owen. sp.) Bombay. (?) sp. Bombay.
PISCES.	ELASMOBRAN-	•
	снп.	Myliobatis, sp. (Lyd.) Punjáb.
	TELEOSTEI.	Diodon foleyi, (Lyd.) Ramri I. and Pt. Blair.
		Capitodus indicus. (Lyd.) Punjáb.
		? (Cycloid scales) Nr. Thayetmyo.
	III. SAU	JROZOIC (MESOZOIC).
	1.	CRETACEOUS SERIES.
REPTILIA.	DINOSAURIA.	Megalosaurus, sp. (Lameta and Trichinopoli)
		Titanosaurus blanfordi. (Lyd.) Lameta gp.
		indicus. (Lyd.) Lameta gp.
		? (unknown reptile.) Lameta gp.
	CROCODILIA.	(amphicælian sp.) (Lyd.) Sind.
	CHELONIA.	? (plates.) Lameta, Rajamahendri, and Sind.
	ICHTHYOSAURI	A. Ichthyosaurus indicus. (Lyd.) Trichinopoli.
PISCES. E	LASMOBRANCHII	
		pristodontus. (Ag.) Trichinopoli.
		Enchodus serratus. (Eg.) Trichinopoli.
		Lamna complanata. (Eg.) Trichinopoli.
		- sigmoides. (Eg.) Trichinopoli.
		Odontaspis constrictus. (Eg.) Trichinopoli.
		oxypeion. (Eg.) Trichinopoli.
		Otodus basalis. (Eg.) Trichinopoli.
		divergens. (Eg.) Trichinopoli.
		marginatus. (Eg.) Trichinopoli.
		minutus. (Eg.) Trichinopoli.
		——— nanus. (Eg.) Trichinopoli.
		semiplicatus. (Eg.) Trichinopoli.
		Oxyrhina triangularis. (Eg.) Trichinopoli.
		sp. (Stol.) Trichinopoli.
		Ptychodus latissimus. (Ag.) Trichinopoli.
	GANOIDEI.	Pycnodus (?), sp. (Stol.) Trichinopoli.
	?	? (scales) Lameta.

2. JURA-TRIASSIC SERIES.

? (scales) Intratrappean. Rajamahendri.

REPTILIA. DINOSAURIA. Ankistrodon indicus (Hux.) Panchet gp. CROCODILIA. (amphicælian sp.) (Lyd.) Chari gp.

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REPTILIA.
             CROCODILIA.
                           Parasuchus, sp. (Hux.) (hislopii. MSS.)
                                                        Maleri gp.
                               - ? sp. (Lyd.) Denwa gp.
              LACERTILIA. Hyperodapedon, sp. (Hux.) Maleri gp.
              DICYNODON- Dicynodon orientalis. (Hux.) Panchet gp.
                                      sp. Panchet gp.
                     TIA. -
              PLESTOSATI-
                     RIA.
                          Plesiosaurus indicus (Lyd.) Umia. gp.
BATRACHIA. LABYRINTHO- Brachvops laticeps. (Ow.) Mangli, gp.
                   DONTIA. Gonioglyptus longrostris. (Hux.) Panchet gp.
                           Pachygonia incurvata (Hux.) Panchet gp.
                           Archegosaurus (?) Bijori gp.
PISCES.
                           Ceratodus hislopianus. (Old.) Maleri gp.
               DIPNOI.
                              ------ hunterianus. (Old.) Maleri gp.
                              —— virapa. (Old.) Maleri gp.
                           Dapedius egertoni. (Syk.) Kota gp.
               GANOIDEI.
                           Lepidotus breviceps. (Eg.) Kota gp.
                            ----- calcaratus. (Eg.) Kota gp.
                            ----- longiceps. (Eg.) Kota gp.
                               pachylepis. (Eg.) Kota gp.
                            Tetragonolepis analis. (Eg.) Kota gp.
                               ----- oldhami. (Eg.) Kota gp.
                                   ---- rugosus.
                                                 (Eg.) Kota gp.
                                  (Scales) Srípermatúr gp. Kota gp.
                             P
                IV. ICHTHYOZOIC (PALÆOZOIC).
                            CARBONIFEBOUS.
                            Sigmodus dubius. (Waag.) Salt-range.
 PISCES.
               GANOIDEI.
               ELASMOB-
                            Poecilodus paradoxus. (Waag.)
                                                         Salt range.
                            Psephodus indicus. (Waag.)
                                                            do.
                BANCHII.
                            Helodopsis elongata. (Waag.)
                                                           do.
                            - abbreviata. (Waag.)
                                                            do.
                            Psammodus, sp.
                                                            do.
                            Petalorbyncus indicus. (Waag.)
                                                            do.
                            Xystracanthus gracilis. (Waag.)
                                                            do.
                                ——— major. (Waag.)
                                                            do
                                    giganteus. (Waag.) do.
                            Thaumatacanthus blanfordi. (Waag) do.
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Abbreviations used in the above.

Ag. = Agassiz; Dav. = Davies; Eg. = Egerton; F. and C. = Falconer and Cautley; Gmel. = Gmelin; Hux. = Huxley; I. = Irawadi

(Irrawaddy) valley, Burma; J. = Jamna; Less. = Lesson; Lyd. = Lydekker; M. Ed. = Milne-Edwards; Myr. = Herman von Meyer; Old. = Oldham; Ow. = Owen; P. = Perim Island, gulf of Cambay; Pent. = Pentland; P: G. = Pem-ganga; Pet. = Peters; Pom. = Pomel; Rüt. = Rütimeyer; S. = Siwaliks (including Punjáb); Sd. = Sind; Stol. = Stoliczka; Sy. = Sylhet; Syk. = Sykes; T. = Tibet; Theo. = Theobald; Waag. = Waagen.

CONCLUSION.

In the foregoing sketch of the fossil vertebrata of India, but few new facts have been recorded, and, indeed, the main objects in penning it were the hope, firstly, of inducing persons interested in scientific enquiries to aid us in our endeavours to increase our knowledge of this interesting branch of science, and, secondly, of making one of those landmarks, so necessary in an ever-increasing subject like the present, from whence new advances can again be made. With regard to the first object, it may be observed that District Officers in India, and other officials, in the course of their periodical professional tours through the country, have far greater opportunities of collecting the larger and more conspicuous fossils than can possibly fall to the lot of the officers of the Geological Survey of India, who are few in number, and who, for years together, are not called upon to visit many parts of the country. To all who have opportunities of travelling through unfrequented parts of India likely to contain fossil remains. the appeal is here made for assistance in our endeavours to obtain a more complete knowledge of the fossil vertebrata of India. Any fossils sent to the Superintendent of the Geological Survey of India (Calcutta) will be most gratefully received, and, after comparison or description, either returned to their owners, or, if presented, carefully preserved in the collection of the Indian Museum.

Note.—Additions to this paper have been made while it was passing through the press, bringing it up to date.

V.—Account of the Verification of some Standard Weights with considerations on Standard Weights in general.—By Col. J. F. Tennant, R. E., F. R. S., Master of Her Majesty's Mint.

(Recd. Jan. 5th; -Read Feb. 4th, 1880.)

When I first contemplated the verification of a series of weights from a primary standard, I had little information as to procedure, and indeed I have till now had little as to details. I had intended in this paper to deal with the verification of a whole series of ounce weights; but circumstances beyond my control have delayed the latter portion, and I think that probably this shorter paper will be as much as the patience of my readers will stand: in it are described, with examples, all the cases I shall meet; while the explanations will, I trust, enable any one to follow my procedure and somehow to verify any other set of weights. This end being gained, the delay of the paper to add the numerical results of farther work, would add little to its popular, or even scientific value, and this circumstance has induced me to offer it in its present state to the Asiatic Society.

I am aware that I am open to the charge of excessive (factitious) accuracy, and I freely admit that I have used an excessive number of decimal places; but the number was originally fixed by the fact that it caused no trouble and saved thought. The difference between the trouble of dealing with 5 or 6 figures and 4 with an arithmometer is, in my case, more than compensated by the absence of the absolute necessity of watching the increase of the last figure: and too, I had not, till I had gone some way with these weighings, so clear an idea of the probable errors as I now have. The systematic calculation of these is, so far as I know, new: it has taught me much, and guided me where I might have gone wrong. I think that it should always be carried out; but of course, the foundation of the calculation—the estimation of the probable error of one comparison, will not commend itself to all men:-those who in other respects may follow my procedure may prefer a different course in this, and, when the system of weighment is different, this datum must be determined in a correspondingly different manner. Even then, I hope, that the conclusions I have come to may have their use, for the evidence they offer of the rapid accumulation of error in multiplying from a small primary standard, is quite independent of the amount ascribed to the error of one comparison.

I have added the Tables requisite in reducing the comparison of weights of varying density and in determining specific gravity. These are deduced from the same data precisely as those used in the British Standards Department, but I have employed Fahrenheit's thermometer, the English inch, and

the English grain, because, to me, those units were more accessible (as they will be to most readers of the English language) and not because I prefer them. I have thought that it was more important to avoid conversions of the data before using them than to adhere to general considerations; just as (with the late Warden of the Standards) I have preferred uniformity of data for reduction; rather than a possible scientific accuracy, which is, after all, not demonstrably gained.

SECTION I .- On Weights.

In May 1879, I received from England a set of Bullion Weights of gilt bronze, with their errors on the Commercial Standard of England roughly given, and a Troy Ounce of Platinum-iridium, with its error in vacuo in terms of the Parliamentary Standard Pound PS. I at the same time received a set of Metric Weights of Platinum-iridium from 100 grammes to one milligram, with their errors in terms of the Kilogramme des Archives, which is the Normal Standard weight of France. My paper here will be confined to dealing with some of the Bullion Weights: and it will be necessary in order to understand the procedure I follow, and also the scientific principles of weighing, that I should give an account of the English system of weights.

Ordinary weights are made of brass, iron, or some other cheap metal, but all these are liable to oxidation, and thus none of these metals is suitable for a Standard. The metal chosen for the English Standard was platinum, which is nearly indestructible. Since then it has been found that, whereas platinum is soft, an alloy with iridium is hard, has the other advantages of platinum, and can be made with sufficient readiness for the purpose required: this alloy is used in my Primary Standards as it is in the European Standards now being made in Paris. The use of such substances for Standard Weights, however, leads to some complication: these metals are heavy; while the metals and alloys ordinarily used are comparatively light. Now the weight of a body in air is different from its weight in vacuo by the weight of the air displaced, and this varies with the state of the atmosphere: consequently the relative weight of a pound of brass and one of platinum, which are alike in vacuo, will, in air, be found to vary continually relatively to each other. In order to avoid the inconvenience of this, it has been found desirable that the Commercial Standard should be of brass or bronze; both of which, having nearly the same density as the metals used in ordinary weights, will show the same differences at all times and places, with sufficient accuracy for commercial purposes; and which, moreover, are cheap enough to allow of the weights of all sizes being made of them. For general Standard purposes, weights are now made of gilt bronze, the gilding preserving them to a great extent from changing by oxidation.

As the Parliamentary Standard of England P S. has its true weight in vacuo.* the first impression would be, that the Commercial Standard in ordinary air should weigh the same as PS, in vacuo: but this has not been the practical solution. When the Houses of Parliament were destroyed in 1834, the English standards were destroyed in them, and the new Standard was meant to be a restoration of the old one. Now the old Standard was a brass Troy Pound made in 1758, of which there were a variety of copies more or less accurate. On the evidence from these, and some other sources, was determined the difference between the lost pound and a piece of platinum, both taken in vacuo. Then (the Government of the day having determined that the new Standard should represent the Avoirdupois. and not the Troy Pound as before), a second piece of Platinum P S. was made which should weigh very nearly 7000 such grains as those of which the destroyed Pound (U) contained 5,760, both being taken in vacuo, and it is believed that the result was accurate to a very small fraction of a grain. thanks to the great labours of Professor Miller. In reverting to the Commercial Pound, that would be 7,000 grains of which U weighed 5,760. both taken in air, and then, as the density of the new commercial Pound was very close to that of U, all sensible uncertainty arising from the destruction of U and the impossibility of knowing its exact density would vanish.

Professor Miller found the Platinum Pound P S. to be 7000.00093 grains of U both weighed in vacuo, and by Act of Parliament, this was declared to be the true standard of weight, and that one grain should be a seven-thousandth part of it. The Commercial Pound W was an imaginary Pound, supposed to be made of brass of a density of 8.15034, which was what Professor Miller estimated as the density of the lost Pound U. Though the standard in vacuo was changed, as above, by a minute quantity, it would have been wrong to change the weight of W in air. In order then that its weight in vacuo should become that of the Pound P S., it became necessary to suppose that this weight in vacuo, and consequently its density, were changed, and to ascribe to it a new density of 8.1430.

The present definition of the English Commercial Pound then is-

[•] I have followed the wording of my predecessors, but I should prefer to call the "weight in vacuo" the "Mass," and restrict the term "weight" to the apparent force exercised. If this distinction were made, the questions involved would be much clearer. The Parliamentary Standard has been treated as one of Mass; hence two of the gilt secondary standards, each of the same Mass as P. S., will not have ordinarily the same weight, unless they have the same specific gravity.

[†] The weight in vacuo was 7000 grains of U, and in consequence of the Act of Parliament it became necessary that it should be the same as that of P S. or 7000 00093 grains of U.

The weight in standard air of a piece of brass whose weight in vacuo is the same as that of PS., and whose density, compared with that of water at its maximum density (the brass being at the freezing point), is 8'1430.

If we know the value of a weight in terms of PS, we shall be able to find its value in terms of W by adding the weight of air displaced by the same weight of brass similar to that of which W is supposed to be made, and deducting that actually displaced by the weight to be determined.

The Standard Platinum-Iridium ounce sent me is certified to weigh (in vacuo) 479-95979 grains in terms of P S., and the density has been assumed as 21.414, which is that of the 100 gramme weight. In English Standard Air its weight is given as 480.00502 grains, but that datum is useless for purposes of reference. It is called E I in the books of the Standards Office in London, and I propose to retain this name.

The ounce weight of the bullion set was certified to weigh 480 00145 grains in vacuo in terms of P S. and 480 00203 grains in English Standard Air in terms of W.

The following matter must be borne in mind in order that the procedure in my weighments may be understood:

The sign = means that the weights on each side of it are equal in vacuo.

- The sign = means that these are equal in air at the time; and, in the case of Commercial Weights, that they are sufficiently equal for practical purposes at all times.
- The sign $exttt{$\sim$}$ means that the weights on each side being in the respective pans of the balance there would be equilibrium. When no division of the scale is mentioned as the resting point, it is assumed to be 10 for Oertling No. 1 and 15 for Oertling No. 2.
- On is one of the set of Gilt Bullion Weights—the subscript number denotes its nominal value in Troy ounces.
- P_n is one of a set of grain weights which have been used for small quantities, and n is the number of grains nominally: all weights not less than 1 grain are of platinum and have been cleaned by incandescence in a spirit-lamp. The tenths of grains are of aluminum and the hundreths of uncertain material.

R₁ and R₂ are two riders (approximately of one-tenth of a grain each) used with the balance Oertling No. 1.

The Tables I have used in my reductions have been calculated by myself to the units of the Barometer and Thermometer scales commonly used in England, and which it was most easy for me to refer to. That for the density of air, has been calculated from the formula given by Professor Miller, in his paper in the Philosophical Transactions, with the necessary changes for units, and for the position of Her Majesty's Mint at Calcutta. The density of water has been calculated from a formula similar to Professor Miller's; but with the constants deduced from the new Tables of the British Standards Office. The other Tables, for the expansion of metals, are deduced from the same data as those of Professor Miller, but the form makes them more compact and convenient without any loss of accuracy. All will be found at the end.

SECTION II.—The Balances.

Oertling No. 1 is a chemical balance by Oertling with a beam 365 m. m. (14.56 inches) between the extreme knife edges. The principal knife edge is 28 m. m. (1.1 inches) long and the smaller ones 16.5 m. m. or 0.65 inches; all are of agate resting on agate planes. The beam is divided for the use of riders, and I have satisfied myself that the divisions are sufficiently accurate for this purpose. The scale is placed on the lower part of the pillar, and is read by a long index attached to the centre of the beam: this is in my opinion, the best arrangement.

Oertling No. 2 is a balance whose beam carries knife edges 404 m. m (15.9 inches) apart. The central knife edge is 38.4 m. m (1½ inches) long and those at the ends, 22 m. m or 0.87 inches. They are all of agate and rest on agate planes. The beam is very strong, and divided with sufficient accuracy for the use of a rider. There is an index of soft iron at each end of the beam to read an ivory scale. The left scale had very fine graduations and appeared to me useless. I have substituted a better one and removed the right scale.

SECTION III.—Density of O Set of Weights.

In order to compare O_1 with EI it is necessary to have a density of O_1 : I have determined that of O_3 and assumed it to be the same as that of O_3 and of the other O weights.

It appears from the papers received from the Standards Office that $O_3 \equiv 3$ Troy ounces $\equiv 1440$ grains with sufficient accuracy for this purpose, its exact value will be seen later.

On July 4th 1879, the balance Oertling No. 1 having been prepared for taking specific gravities, and a platinum hook, intended to support O_3 in water, having been hung by a fine wire of platinum so as to be immersed in distilled water; O_3 was placed in the pan in air, and counterbalanced with weights. O_3 being then placed in the hook, and all air bubbles carefully removed, it was found that; X being about 1490.2 grains:

 $X \simeq O_3$ in water (temp. = 84°. 1) + hook &c. in water + $(O_{\cdot 3} + O_{\cdot 04} + O_{\cdot 005} + O_{\cdot 005})$ in air + 4. $\frac{R_2}{10}$ at 10·02 divisions of the scale—

then, removing O₈ from water, carefully drying it, and placing it in the pan, I found after adding 180 minims of water

 $X \simeq O_3$ in air + hook &c. in water + $2.72 \frac{R_2}{10}$ at 10.02 divisions. Hence the loss of weight apparently = $O_{\cdot 3}$ + $O_{\cdot 04}$ + $O_{\cdot 005}$ + $O_{\cdot 004}$ + $1.28 \frac{R_2}{10}$.

My approximate calculations gave me the sum of the above four weights as 167.5400 grains, and the value of the rider is approximately $\frac{1}{10}$ th of a grain, the difference from the true value being negligible. Hence the loss of weight between air and water was 167.5528 grains, and, though I did not observe the Barometer, it may be considered as 29.46, and the temperature $87^{\circ}.5$; this gives Δ O₃ = 8.5649.

Again on July 7th, I found in the same way.

(A)
$$X + 5 \frac{R_1}{10} = 0_s$$
 in water + hook &c. in water + 167.54 grains + $3 \frac{R_2}{10}$ at 13 30 Div.

(B) $X + 5 \frac{R_1}{10} = 0_s$ in water + hook &c. in water + 167.54 grains + $6 \frac{R_2}{10}$ at 4.72 Div.

and, after adding 169 minims of water.

(C)
$$X + 5 \frac{R_1}{10} = 0_s$$
 in air + hook &c. in water + $7 \frac{R_2}{10}$ at 14.80 Div. Bar. 29°445.

(D)
$$X + 5 \frac{R_1}{10} = 0$$
, in air + hook &c. in water + $9 \frac{R_2}{10}$ at 8.35 Div.

Hence by interpolating between (A) and (B)

Thus the loss of weight was apparently 167.4965 grains, and Δ O₈ = 8.5676. Giving this last result triple weight, on account of better observing, we have as a mean; Δ O₈ = 8.5669: which may be considered the density for all the weights of this set; and which will not be altered by the true values of the weights used, being substituted for the approximate ones.

SECTION IV .- System of Weighments.

I have adopted a uniform system of weighment for comparing the weights. Some years ago I made a considerable number of experiments on the species of errors which occurred in practice, and the present system is the outcome: there have been minute deviations, but in all material points the procedure has been uniformly followed, and I think it has been successful in eliminating all progressive errors. The principal of these is the tendency of the arms of the balance to expand unequally with temperature, but there are others which have occasionally been found. I annex specimens of the form I have used in work.

The weights to be compared being placed in the pans, a preponderance is given to one side of the balance; so as to make the resting point, when the whole is in equilibrium, lie on one side of the centre point; yet so slightly, that the weight used to get the value of the scale, shall deflect the resting point to the other side. In the first example with Oertling No. 1, it will be seen, that with EI in the left pan and O1 in the right, the Right Rider was placed at 1.2 of the beam scale; in this state the index had its resting point at 7.54 divisions (10 being the middle). Then the weight Pos was added to the left side and the resting point became 15.81 Div. Each resting point is deduced from 4 readings, two low l₁ and l₂, and two high h_1 and h_2 . The beam having been carefully released, the first excursion outwards, and the return towards the scale centre, are neglected; and the next four readings of the extremes of oscillation taken. first reading will thus usually be low, if the resting point be low; and high, if that be high: but, when signs of irregularity occur, this may not be the case, as I have always, in such cases, freely omitted readings till the oscillations have become regular. Then, supposing a low reading first, $\frac{l_1 + 2h_1 + l_2}{4}$ and $\frac{h_1+2l_2}{4}+\frac{h_2}{4}$ would be readings of the resting points, and the sums in the numerators have been rapidly formed separately during the work, added, and divided by 8. This has been afterwards checked by $\frac{l_1 + h_2 + 3(l_2 + h_1)}{8}$: of course, when h comes first, the h's take the place of the l's in these formulæ, and vice verså.

We thus have two "partial weighments"

EI
$$ho_1 + 1.2 \frac{R_2}{10}$$
 at 7.54 divisions and
EI + P_{.01} ho_0 O₁ + 1.2 $\frac{R_2}{10}$ at 15.81 divisions

from which I get, by interpolation, as a result of the "weighment"

EI
$$rac{1}{2} = O_1 + 1.2 \frac{R_2}{10} - P_{.01} \frac{2.46}{8.27} \text{ or } O_1 + 1.2 \frac{R_2}{10} - 0.297 P_{.01}$$

The second weighment is made after the weights are interchanged in the pans and the result deduced the same way. These together make one "comparison;" and then a second comparison is made, every operation being followed, but precisely in the reverse order, to make a "complete comparison." The result of the four equations when summed is

4 EI
$$\equiv$$
 4 O₁ + O·191 P_{·01} or
EI \equiv O₁ + O·04775 P_{·01}

The interpolations are made with sufficient accuracy with a slide rule.

In all the comparisons of the O set and P set, except those of EI with O₁, which were made with the balance Oertling No. 1, I have used one of the riders (the right) to add a constant weight to one side and the other in variable positions. Assuming that the rider can be accurately placed on the divisions, and that these are sufficiently accurate, it seems to me that I may safely use the rider in this way, and that the error of determination of the weight of the rider will thus be of less importance than that of a small weight.

In the case of the very small weights I have added the weight P₂₄ to one pan, and P_{3.4} to the other, in order to steady them, with great advantage.

Section V.—Determination of O₁, in terms of the English Commercial Pound.

I have before mentioned that I have received as a Standard a Troy ounce of Platinum-Iridium, whose weight in terms of the Parliamentary Standard Pound P S. is 479 95979 grains of P S.; and I have explained the relations between the English Standard Pound and the commercial Pound. In order that I may determine the errors of the Bullion set of Weights, it is necessary that I should determine O_1 in terms of the English Commercial Pound: I have it is true the determination made in London, but it is necessary to verify this, not only to make the standard of weight now, identical with that I should get again, but also because the gilt weights may have slightly changed in the long voyage.

The Barometer I have used is an Aneroid Barometer by Browning, which I have found give corrected Barometer readings without sensible error. I have, except in the first comparison, used two Thermometers which were examined for me some years ago at Kew, and whose zero point I have recently re-determined: these were suspended in the balance case of Oertling No. 1, so as to hang about half way between

the pillar carrying the central plane, and the suspensions of the scale pans. The Humidity has been deduced from a new Masons Hygrometer: I have not the errors of its Thermometers, but they are modern, and not likely to have any producing sensible corrections to my result.

The following is a specimen of computation for the comparison of EI and O_1 which is entered in the type form; in it, $v ext{ EI} = \text{volume of water}$ at its greatest density which is displaced by EI at 32°. F.

it therefore
$$=\frac{wt. \text{ EI}}{\Delta \text{EI}} = \frac{479 \cdot 95979}{21 \cdot 414} = [1 \cdot 35051]$$

similarly $v O_1 = \frac{479 \cdot 99760}{8 \cdot 5669} = [1 \cdot 74842]$

May 24th, 1879 A. M.

Commenced at 6 h. 48 m.

Ended at 7 h. 33 m.

Weight EI in Vacuo =
$$479.95979$$
 of P S.
Air displaced = -0.025517
EI = 479.934273
Air displaced by O_1 = $+$ 0.063834
 O_1 = EI - 0.000475*
 O_1 = 479.997632

[•] In section IV, I found EI = $O_1 + 0.4775 P_{.01}$ and (Sec. VI) $P_{.01} = 0.009947$ grains.

Abstract of Comparisons.

Mean $O_1 = 479.997206 \pm 0.000115$ P S. grains.

I have received, from the Meteorological Reporter to the Government of Bengal, the following mean data for Calcutta which I take as the definition of Standard Air

Hence I have weight of $O_1 = 479.997206$ grains of P S. Deduct displaced Standard Air = -0.065178

Add Standard Air for $\frac{480}{5000}$ W = + 0.068571

 $O_1 \equiv 480.000599$ grains of English Commercial Pound.

This value differs slightly from that sent me and which I have quoted before.

SECTION VI.—On the determination of the errors of single weights.

In the interval between O_1 and O_{10} there are, in all English bullion sets, weights O_5 , O_4 , O_3 , and O_2 ; so between O_{10} and O_{100} come O_{20} O_{30} O_{40} and O_{50} , and so on.

Between these weights we may make comparisons giving the following equations:

$$\begin{array}{l} O_{10} \equiv O_5 + O_4 + O_1 + x_1 \pm e \, (a) \\ \equiv O_5 + O_8 + O_2 + x_1' \pm e \, (b) \\ \equiv O_4 + O_3 + O_2 + O_1 + x_1'' \pm e \, (c) \\ O_5 \equiv O_4 + O_1 + x_3 \pm e & e \text{ being the } p. \text{ e. of one com-} \\ O_6 \equiv O_3 + O_2 + x_3 \pm e & [parison.] \\ O_4 = O_3 + O_1 + x_4 \pm e \\ O_3 = O_2 + O_1 + x_5 \pm e \\ \end{array}$$

$$\begin{array}{l} P_{10} = O_1 + O_2 + O_3 + O_4 + O_5 + O_5$$

$$O_{3} \equiv 3 O_{1} + x_{5} + x_{4} - x_{8} + x_{9} \pm e \sqrt{4}$$

$$O_{4} \equiv 4 O_{1} + x_{5} + 2x_{4} - x_{3} + x_{9} \pm e \sqrt{7}$$

$$O_{5} \equiv 5 O_{1} + x_{5} + 2x_{4} - x_{8} + 2x_{9} \pm e \sqrt{10}$$

$$O_{10} \begin{cases} \equiv 10 \ O_1 + 2x_5 + 4x_4 - 2x_3 + 3x_2 + x_1 \pm e \sqrt{34} \text{ from } (a) \\ \equiv 10 \ O_1 + 2x_5 + 4x_4 - 3x_3 + 4x_2 + x_1' \pm e \sqrt{46} \text{ from } (b) \\ \equiv 10 \ O_1 + 2x_5 + 4x_4 - 3x_3 + 3x_2 + x_1'' \pm e \sqrt{39} \text{ from } (c) \end{cases}$$

which equations give the ascending series; and it is important to note, that if the probable error of the observations be alike, there is a disadvantage in using any comparison but (a), and that even if (b) and (c) be observed as checks, they should not be used in computing, as they will lower the weight of O_{10} , on the accuracy of which we are dependent for continuing the upward series; thus the mean value of O_{10} from (a) and (c) will be

 $O_{10} \equiv 10 O_1 + \frac{1}{3} (4x_5 + 4x_4 - 5x_3 + 6x_2 + x_1 + x_1'') \pm e \sqrt{\frac{1+3}{3}}$ and if the series (b) had been involved the loss of probable accuracy would have been greater.

Next as to descending or decreasing series from W_{10} .

1. Descending through (a)

1st. Descending through (a)
$$O_{5} \equiv \frac{5}{10} O_{10} + \frac{x_{5} - x_{1}}{2} \pm e \sqrt{\frac{50}{10}}$$

$$O_{4} \equiv \frac{5}{10} O_{10} + \frac{1}{10} (2x_{5} + 4x_{4} - 2x_{3} - 2x_{2} - 4x_{1}) \pm e \sqrt{\frac{54}{10}}$$

$$O_{5} \equiv \frac{3}{10} O_{10} + \frac{1}{10} (4x_{5} - 2x_{4} - 4x_{5} + x_{2} - 3x_{1}) \pm e \sqrt{\frac{50}{10}}$$

$$O_{5} \equiv \frac{3}{10} O_{10} - \frac{1}{10} (4x_{5} - 2x_{4} + 6x_{5} - 4x_{5} + 2x_{1}) \pm e \sqrt{\frac{70}{10}}$$

$$O_{1} \equiv \frac{1}{10} O_{10} - \frac{1}{10} (2x_{5} + 4x_{4} - 2x_{3} + 3x_{5} + x_{1}) \pm e \sqrt{\frac{54}{10}}$$
Again descending through (b)
$$O_{5} \equiv \frac{5}{10} O_{10} + \frac{1}{3} (x_{3} - x_{1}') \pm e \sqrt{\frac{50}{10}}$$

$$O_{4} \equiv \frac{5}{10} O_{10} + \frac{1}{10} (2x_{5} + 4x_{4} + 2x_{5} - 6x_{5} - 4x_{1}') \pm e \sqrt{\frac{70}{10}}$$

$$O_{5} \equiv \frac{3}{10} O_{10} + \frac{1}{10} (4x_{5} - 2x_{4} - x_{3} - 2x_{5} - 3x_{1}') \pm e \sqrt{\frac{35}{10}}$$

$$O_{5} \equiv \frac{3}{10} O_{10} - \frac{1}{10} (4x_{5} - 2x_{4} + 4x_{3} - 2x_{5} + 2x_{1}') \pm e \sqrt{\frac{35}{10}}$$

$$O_{1} \equiv \frac{1}{10} O_{10} - \frac{1}{10} (2x_{5} + 4x_{4} - 3x_{3} + 4x_{5} + x_{1}') \pm e \sqrt{\frac{50}{10}}$$
Also descending through (c)
$$O_{5} \equiv \frac{5}{10} O_{10} + \frac{x_{5} + x_{5}}{2} - \frac{x_{1}''}{2} \pm e \sqrt{\frac{75}{10}}$$

$$O_{4} \equiv \frac{5}{10} O_{10} + \frac{1}{10} (2x_{5} + 4x_{4} + 2x_{3} - 2x_{5} - 4x_{1}'') \pm e \sqrt{\frac{50}{10}}$$

$$O_{5} \equiv \frac{3}{10} O_{10} + \frac{1}{10} (4x_{5} - 2x_{4} + 4x_{5} - 2x_{5} - 4x_{1}'') \pm e \sqrt{\frac{50}{10}}$$

$$O_{5} \equiv \frac{3}{10} O_{10} + \frac{1}{10} (4x_{5} - 2x_{4} + 4x_{5} - 4x_{5} + 2x_{1}'') \pm e \sqrt{\frac{50}{10}}$$

$$O_{5} \equiv \frac{3}{10} O_{10} + \frac{1}{10} (4x_{5} - 2x_{4} + 4x_{5} - 4x_{5} + 2x_{1}'') \pm e \sqrt{\frac{50}{10}}$$

$$O_{1} \equiv \frac{1}{10} O_{10} - \frac{1}{10} (4x_{5} - 2x_{4} + 4x_{5} - 4x_{5} + 2x_{1}'') \pm e \sqrt{\frac{50}{10}}$$

$$O_{1} \equiv \frac{1}{10} O_{10} - \frac{1}{10} (2x_{5} + 4x_{4} - 3x_{5} + 3x_{5} + x_{1}'') \pm e \sqrt{\frac{50}{10}}$$

If we were to be guided here by the same consideration as before, we should absolutely prefer the use of series (a) alone, but it is easy to see, that as the probable error of O_1 involves only $\frac{1}{10}$ of that of O_{10} ; the

determination of its weight will be almost entirely dependent on the error generated in the comparisons of the group* of the series, and not on that derived from the starting weight: this renders the choice less important.

As a matter of fact I have worked both through (a) and (b) taking the mean result and in this case.

$$\begin{array}{l} O_{8} \equiv \frac{8}{10} O_{10} + \frac{1}{4} \left(x_{8} + x_{9} + x_{1} + x_{1}'\right) \pm e \sqrt{\frac{35}{10}} \\ O_{4} \equiv \frac{4}{10} O_{10} + \frac{1}{20} \left(4x_{8} + 8x_{4} - 8x_{2} - 4x_{1} - 4x_{1}'\right) \pm e \sqrt{\frac{45}{10}} \\ O_{8} \equiv \frac{3}{10} O_{10} + \frac{1}{20} \left(8x_{8} - 4x_{4} - 5x_{8} - x_{8} - 3x_{1} - 3x_{1}'\right) \pm e \sqrt{\frac{31}{10}} \\ O_{9} \equiv \frac{3}{10} O_{10} - \frac{1}{20} \left(8x_{8} - 4x_{4} + 10x_{8} - 6x_{9} + 2x_{1} + 2x_{1}'\right) \pm e \sqrt{\frac{56}{10}} \\ O_{1} \equiv \frac{1}{10} O_{10} - \frac{1}{30} \left(4x_{8} + 8x_{4} - 5x_{8} + 7x_{8} + x_{1} + x_{1}'\right) \pm e \sqrt{\frac{35}{10}} \end{array}$$

My choice was a matter of accident, but it turns out that the sum of the squares of the probable errors of all the deduced weights is less than for any one of the single series.

The other system of weights, which I have in this paper slightly to deal with, is what I shall call the "English grain system." In it the weights interpolated between 10 and 1 are 6, 3 and 2. Thus starting from either end of the decad there are four weights to be derived; but among these weights alone, only three equations can be obtained.

$$P_{10} = P_{6} + P_{3} + P_{1} + x_{1}$$

 $P_{6} = P_{8} + P_{9} + P_{1} + x_{9}$
 $P_{5} = P_{9} + P_{1} + x_{3}$

To make a definite resect the best plan is to use a second P_1 called P_1' : $P_{-1} + P_{-3} + P_{-1}$ from the next lower decad height be used but the equations would not be independent for the separate decads.

$$P_{\bullet} = P_{1} + P_{1}' + x_{\bullet}$$
 and $P_{1} = P_{1}' + x_{\bullet}$

and we now have 5 equations to determine 5 quantities, and the result is definite. Of course by substituting P'_1 for P_1 , we can get 3 more equations like the first three, but the labour would be increased, and the result would still be definite, though slightly more accurate, especially as regards the spare weight P_1 .

From the equations we have; in ascending (increasing weights)

$$\begin{aligned} & \mathbf{P_1'} = \mathbf{P_1} - x_5 \pm \mathbf{e}. \\ & \mathbf{P_2} = 2 \ \mathbf{P_1} - x_5 + x_4 \pm \mathbf{e} \ \sqrt{2} \\ & \mathbf{P_3} = 3 \ \mathbf{P_1} - x_5 + x_4 + x_5 \pm \mathbf{e} \ \sqrt{3} \end{aligned}$$

• I use the term decad to include the weights from 0.1 to 1, or from 1 to 10, &c., the last being ten times the first; and a group of equations consists of those connecting the weights of a decad.

$$P_{s} = 6 P_{1} - 2x_{s} + 2x_{s} + x_{s} + x_{s} \pm e \sqrt{10}$$

$$P_{10} = 10 P_{1} - 3x_{s} + 3x_{s} + 2x_{s} + x_{s} + x_{1} \pm e \sqrt{24}.$$

While descending, we have

$$\begin{array}{l} P_{s} = \frac{6}{10} P_{10} - \frac{1}{10} \left(2x_{s} - 2x_{4} + 2x_{3} - 4x_{3} + 6x_{1} \right) \pm e \sqrt{\frac{8}{10}} \\ P_{s} = \frac{8}{10} P_{10} - \frac{1}{10} \left(x_{5} - x_{4} - 4x_{5} + 3x_{5} + 3x_{1} \right) \pm e \sqrt{\frac{3}{10}} \\ P_{s} = \frac{9}{10} P_{10} - \frac{1}{10} \left(4x_{5} - 4x_{4} + 4x_{5} + 2x_{5} + 2x_{1} \right) \pm e \sqrt{\frac{6}{10}} \\ P_{1} = \frac{1}{10} P_{10} + \frac{1}{10} \left(3x_{5} - 3x_{4} - 2x_{5} - x_{5} - x_{1} \right) \pm e \sqrt{\frac{9}{10}} \\ P_{1}' = \frac{1}{10} P_{10} - \frac{1}{10} \left(7x_{5} + 3x_{4} + 2x_{5} + x_{5} + x_{1} \right) \pm e \sqrt{\frac{9}{10}}. \end{array}$$

SECTION VII.

I now proceed to the determination of the actual values of the weights below O_1 , and of the P set, in commercial grains. The equations have all been determined in terms of the rider R_1 , in the balance Oertling No. 1, and they are given in this way. Of course the whole of the computations were made with this unknown factor, but it has been determined (see page 56) and the value has been substituted in the results to save repetition. The differences between the two determinations of the constant term in each equation are given, and from them is derived a probable error of one equation. I had intended that the observations in each decad should be separately valued, but when that is done the results are so nearly alike that it seems unnecessary to adhere to this. The mode of determining the probable error of each weight is the subject of the next section, but the values are given in this.

Value of Weights of W set below W, with Balance Oertling No. 1.

I have here the following equations:

			1-					
0,	≡ 0.₅	+ 0.	+ 0.,	-0.213325	\mathbf{R}_{1}	Difference	=	26 00
0,	≡ 0.₅	+ O. ₃	+ O.,	 0·238825	,,	,,	=	145 0
O. 5	= 0.₄	+ 0.1		0.001800	"	,,	=	350
O. 5	= 0.₃	+ O.,		0.124325	"	,,	=	500
0.	= 0.₃	+ 0.,		— 0·002913	,,	"	=	825
O. a	≡ 0.,	+ 0.,		0.011113	,,	**	=	275
0.,	= O.₀ s	+ 0.04	+ 0.01	 0·033200	R,	Difference	=	200
_	≡ 0. ₀ , ≡ 0. ₀ ,		_	0·033200 0 042213		Difference		200 2925
0.,		+ 0.08	+ O.o.		,,		=	
O., O.,	≡ 0.₀₅	+ 0.03 + 0.01	+ 0.0.	0 042213	"	,,	= =	2925
O. ₁ O. ₀₅ O. ₀₅	≡ 0. _{0.5} ≡ 0. _{0.4}	+ 0.03 + 0.01 + 0.03	+ O. ₀	0 042213 0 020938	" "	"	= = =	2925 475

```
Difference = 425
O_{.01} \equiv O_{.005} + O_{.004} + O_{.001} - 0.012263 R_1
O_{.01} \equiv O_{.008} + O_{.008} + O_{.008} - 0.021500
                                                                        = 150
                                                                33
O_{.005} \equiv O_{.004} + O_{.001}
                                      -- 0.076963 ,,
                                                                        = 1625
0_{.008} \equiv 0_{.008} + 0_{.008}
                                      -0·015813 "
                                                                        = 1725
                                                                ,,
O_{\cdot oo4} \equiv O_{\cdot oo8} + O_{\cdot oo1}
                                      -- 0·04·0638 "
                                                                            675
                                                                ,,
                                      100
O_{.008} \equiv O_{.008} + O_{.001}
                                      -- 0.016100 R,
                                                           Difference =
                                                                           200
O_{.085} \equiv O_{.08} + O_{.005}
   From these equations I deduce
              grs.
                                                    grs.
       \equiv 240.000300 + 0.056006 R_1 \equiv 240.005927
0.,
       = 192.000240 + 0.127762 "
0.4
                                                 192.013076
```

```
p. e. = 0.000064
                                                                  0.000060
O.,
       = 144.000180 + 0.100631
                                           144 010290
                                                                  0.000047
                                                             22
           96.000120 + 0.081700
                                            96.008328
                                                                  0.000048
0.
O.,
           48.000060 + 0.030044
                                             48.003078
                                                                  0.000037
O. 0 5
           24.000030 + 0.020606
                                            24.002100
                                                                 0.000033
           19.200024 + 0.015988
                                            19.201630
                                                                  0.000040
0.,4
       0.000033
Ο 。,
           14.400018 + 0.021269
                                            14.402155
                                                             "
            9.600012 + 0.031475
                                             9.603180
                                                                  O·000012
O.,,
            4.800006 + 0.025537
                                             4.802574
                                                                  0.000035
0.01
            2.400003 + 0.030932
                                                                 0.000033
0.00 =
                                             2.403111
            1.920002 + 0.065261
                                                                  0.000040
O. 。。 =
                                             1.926559
O. o o s =
            1.440002 - 0.018011
                                                                  0.000033
                                             1.438193
            0.960001 + 0.033130
                                             0.963329
                                                                  0.000042
O. 0 0 8
            0.480001 + 0.042634
                                             0.484284
                                                                  0.000035
O_{\cdot 001} \equiv
           12.000015 + 0.036101 ,
                                                                  0.000077
                                            12.003642
O_{\cdot o_{\mathbf{a},\mathbf{b}}} =
                                                             ,,
```

The two largest weights P_{34} and P_{34}^* of the P set are each approximately equal to 24 grains and their sum is of course nearly = O_{1} but they are of platinum while O_{1} is of gilt bronze. Small as these are the errors cannot be neglected when accuracy is required. The purpose of the determination being mainly to get the values of the small weights of the P set with accuracy so that they may be used to determine differences, it is enough to correct the value above given of O_{1} so that the deduced value of $P_{134} + P_{14}^*$ may be the same as if the comparison had been made in standard air. For all ordinary purposes the resulting values of these weights may be used without correction.

I have found that 48 grains of platinum would weigh less in my standard air than under the circumstances of the observation by 0.000063 grains. Also $O_1 \equiv P_{34} + P_{34}^* + 0.050238 R_1$.

```
The value of O., is \equiv 48.000060 + 0.030044 R_1... in actual air P_{34} + P_{34}^* \equiv 48.000060 - 0.020194 R_1 and the correction to standard air is = 0.000063. Hence in standard air P_{34} + P_{34}^* \equiv 47.999997 - 0.020194 R_1
```

I shall for convenience write M for 47.999997 grains and place the equations so far as ey are necessary to determine the weights down to P₁ in a form suitable for use thus—

```
\begin{array}{c} \begin{array}{c} \text{Diff.} \\ \text{24} + P_{34}^{**} \\ \text{24} - P_{34}^{**} \\ \end{array} \\ \begin{array}{c} -P_{16}^{**} - P_{6} \\ \end{array} \\ \begin{array}{c} -P_{16}^{**} - P_{16} \\ \end{array} \\ \begin{array}{c} -P_{16}^{**} - P_{16}^{**} - P_{16}^{**} \\ \end{array} \\ \begin{array}{c} -P_{16}^{**} - P_{16}^{**} - P_{16}^{**} \\ \end{array} \\ \begin{array}{c} -P_{16}^{**} - P_{16}^{**} - P_{16}^{**} \\ \end{array} \\ \begin{array}{c} -P_{16}^{**} - P_{16}^{**} - P_{16}^{**} - P_{16}^{**} \\ \end{array} \\ \begin{array}{c} -P_{16}^{**} - P_{16}^{**} - P_{16}^{**} - P_{16}^{**} - P_{16}^{**} \\ \end{array} \\ \begin{array}{c} -P_{16}^{**} - P_{16}^{**} - P_{16}^{**} - P_{16}^{**} - P_{16}^{**} - P_{16}^{**} \\ \end{array} \\ \begin{array}{c} -P_{16}^{**} - P_{16}^{**} - P_{16
```

I have tried various ways of dealing with these equations but, when the probable errors are wanted, the method of least squares is the easiest. I thus get—

```
grs.
     P_{34} \equiv 23.999999 - 0.006997 R_{1} \equiv 23.999296 p. e. = 0.000042
     P_{\bullet,\bullet}^* = 23.999999 - 0.003185, = 23.998679
                                                                      0.000042
     P_{\bullet 0} = 19.999999 - 0.014515 , = 19.998541
                                                                      0.000050
     P_{16} \equiv 15.999999 - 0.006007 = 15.999396
                                                                      0.000049
     P_{10} = 9999999 - 0.009026 = 9.999092
                                                                      0.000043
     P_6 \equiv 6.000000 - 0.015531 \, \text{,} \equiv 5.998440
                                                                      0.000013
     P_a \equiv 3.000000 - 0.006360 \, \text{,} \equiv 2.999361
                                                                      0.C00035
     P_{\bullet} \equiv 2.000000 + 0.001371 , \equiv 2.000137
                                                                      0.000050
     P_1 \equiv 1.000000 + 0.008077 , \equiv
                                                1.000811
                                                                      0.000039
     P', \equiv 1.000000 + 0.002461 , \equiv
                                                  1.000247
                                                                      0.000043
     Further P_1 \equiv P_{.6} + P_{.3} + P_{.1} + 0.000038 R_1
                                                                    Diff.
                                                                            725 R.
               P_{.a} \equiv P_{.a} + P_{.a} + P_{.1} + 0.005525,
                                                                               0 "
              P_{\bullet} \equiv P_{\bullet} + P_{\bullet}
                                             - 0·004675 ..
                                                                            500 "
                                          + 0.006963 "
              P_{\cdot s} \equiv P_{\cdot 1} + P'_{\cdot 1}
                                                                           1325 "
               P_{\cdot,\cdot} \equiv P'_{\cdot,\cdot}
                                             + 0.005813 "
                                                                            525 "
Whence P. _{6} \equiv 0.600000 + 0.002673 R_{1} \equiv \stackrel{\text{grs.}}{0.600269} p. e. = 0.000056
          P_{a} \equiv 0.300000 + 0.005647 , \equiv 0.300567
                                                                       0.000035
          P_{-2} \equiv 0.200000 + 0.002832 , \equiv 0.200285
                                                                       0.000042
          P_{1} \equiv 0.100000 + 0.000842 \, \text{,} \equiv 0.100085
                                                                       0 000028
          P'_{1} = 0.100000 - 0.004971 = 0.099501
                                                                       0.000045
```

By weighing the riders against the nearly equal weight P., I have

$$R_1 \equiv P_{\cdot_1} + 0.003813 R_2$$
 Diff. 425
 $R_2 \equiv P_{\cdot_1} + 0.000375 R_1$, 600

Substituting successively for the value of R_1 , of $P_{\cdot 1}$, and of R_2 we get

$$\begin{array}{c} R_1 \equiv 0.1003814 + 0.000847 \; R_1 \equiv 0.100466 \; \mathrm{grs.} \; p. \; e. = 0.000062 \\ R_2 \equiv 0.100000 \; + 0.001217 \; R_1 \equiv 0.100122 \; , \quad , \quad = 0.000062 \\ \mathrm{Also-P.}_1 \equiv P_{\cdot 0.6} \; + P_{\cdot 0.8} \; + 0.089038 \; R_2 \qquad \mathrm{Diff.} \qquad 825 \\ P_{\cdot 0.6} \equiv P_{\cdot 0.3} \; + P_{\cdot 0.8} \; + 0.104750 \; , \qquad , \qquad 1550 \\ P_{\cdot 0.8} \equiv P_{\cdot 0.8} \qquad + 0.105075 \; , \qquad , \qquad 900 \\ P_{\cdot 0.1} \equiv \qquad \qquad 0.099438 \; , \qquad , \qquad 137 \\ \mathrm{Whence} \; P_{\cdot 0.6} \equiv \frac{1}{3} \; P_{\cdot 1} \; - 0.059467 \; R_2 \equiv 0.060769 \; p. \; e. = 0.000047 \\ P_{\cdot 0.8} \equiv \frac{1}{3} \; P_{\cdot 1} \; - 0.029571 \; , \qquad \equiv 0.030400 \; , \qquad 0.000034 \\ P_{\cdot 0.2} \equiv \frac{1}{3} \; P_{\cdot 1} \; - 0.134646 \; R_1 \equiv 0.019881 \; , \qquad 0.0000047 \\ P_{\cdot 0.1} \equiv \qquad \qquad 0.099438 \; , \qquad \equiv 0.009956 \; , \qquad 0.000056 \\ \end{array}$$

Section VIII.—Determination of the probable errors of the values of the O and P sets.

In Section VI, I have shown that if the probable error of the constant terms in the equations of a group be known, we can determine the probable errors of the determinations in the group, so far as they depend on it: and we have now to consider what may be taken as the probable error of one determination.

Each coefficient of R is derived in the preceding work from two determinations which rarely agree. The differences are noted in terms of the 6th decimal place of the coefficient. If we were certain that the true values of the constants lay between the determinations, then, calling the difference of the two 2a, we should have $\frac{\sum a}{n}$ = the mean of errors

and p. e. of an equation $= e = 0.8454 \frac{\sum a}{n}$; but this value is clearly too small; because, if the occurrence of positive and negative errors be equally probable, then there is an even chance that a fourth of the values of 2a will be the difference and not the sum of the two actual errors.

I prefer therefore to use the formula

mean of errors =
$$\frac{\sum v}{\sqrt{m \ (m-1)}}$$
: m being the number of complete comparisons

and probable error = 0.8454
$$\frac{\sum v}{\sqrt{m(m-1)}}$$

applying this to any one determination we shall have its probable error

$$= 0.8454 \frac{2 a}{\sqrt{2 \times 1}} = 0.8454 \sqrt{2a} = 1.1955 a$$

Of course this is a very uncertain estimation, but we have a good many such equations, and the mean of the values may I think be taken as the fairest estimate. If then so be the number of equations, I take

p. e. of any one determination is 1.1955
$$\frac{\sum a}{n}$$

The group of equations determining the P weights would give the probable error from their residuals; but, there being only 12 equations to determine 10 quantities, I do not think this is so satisfactory as the above method; and I have used, for evaluating the errors in them, the weights of the results, deduced as usual, combined with the $p.\ e.$ of an equation derived as above. Assuming that we may neglect the difference between the values of R_1 and R_2 in these differences, we have 41 values of 2a; and it does not seem that there is any marked tendency to decrease with the weights: I therefore take the mean of all and I get

$$\frac{\sum a}{n}$$
 = 463.53 R p. e. = 554.16 R = 55.651 = e of Section VI

in which R is taken 0·100464 =
$$\frac{36 R_1 + 5 R_2}{41}$$

Hence e3 is 3097.0

The probable error of any determination as of that of $O._{os}$ for instance, depends:—

1st on the amount arising from its own group.

2nd probable error of the value assumed as known: in this case O., 8rd on the probable error of the rider which was employed in taking the difference of weights in the pans.

Lastly O₁ itself has its probable error 0.000115 grains from the determinations; but there is also a portion dependent on P_{.01}, which is involved in determining the difference between it and EI, the mean factor of P_{.01} being 0.0877. It is necessary, therefore, to start our evaluations with values of the probable errors of R₁ R₂ and P_{.01}; and, fortunately, these are readily determined.

Let E be the p. e. of P., from all sources except R,

e as before the p. e. of one determination

 ϵ the p. e. of \mathbf{R}_1

It will be seen from the table of deduction of probable errors that the value of E² is 758.2 and that it involves nothing unknown.

Hence
$$(p.e. R_1)^s = \epsilon^s$$

= $(1.003813)^s E^s + (0.000842)^s \epsilon^s + e^s$
= $764.0 + 0.0000007 \epsilon^s + 3097.0 = 3861.0$
 $\therefore \epsilon = 0.000062 = \frac{1}{10^s} \sqrt{3861.0}$

again p. e. $R_s = \sqrt{E^s + e^s + 0.000375^3 \epsilon^s} = \frac{1}{10^s} \sqrt{3861.0} = 0.00062$ p. e. $P_{0.0} = \sqrt{e^s + 0.099438^s (R_s)^s} = \sqrt{3135.2} = 0.000056$ Determination of Probable Errors.

	From group.	From preceding groups.	From EI.	From R ₁ .	From P. o 1.	Total.	Probable error.
1			13225.0	•••	24·1	13249·1	0.000115
ا .	774·3		8306.2	12.1	6.0	4098.6	64
	1362.7		2116.0	64.2	8.9	3546.3	60
	960.1		1190.3	41.1	2.2	2193.7	47
٠,	1784.3	•••	529.0	257	1.0	2290.0	48
.,	1207.8		132.3	3.5	0.2	1343.8	87
.05	774.3	301.9	33.1	1.6	0.1	1111.0	33
.04	1362.7	193.2	21.2	1.0	,,	1578.1	40
·oa	960.1	108.7	11.9	1.7	,,	1082.4	33
.09	1734.3	48.3	5.3	3.8	,,	1791.7	42
.01	1207.8	12.1	1.3	2.5	,,	1223.7	35
·005	774.3	305.0	0.3	8.7	,,	1083.3	33
.004	1362·7	195.2	0.2	16.4	,,	1574.5	40
.003	960.1	109.8	0.1	1.2	" -	1071.2	33
.008	1734.3	48.8	0.1	4.2	,,	1787.4	42
.001	1207.8	12.2	.,	7:0	"	1227:0	35
·035	8097:0	2861.9	8.3	19.8	"	5987.0	77
9.4	1447.5	301.9	33.1	0.2	0.1	1782.8	4.2
*	1447.5	301.9	83.1	"	0.1	1782.6	42
	2810.6	209.7	22.9	o1	,,	2543.2	50
	2229.2	134.2	14.7	0.1	,,	2378.2	4
	1806.4	52.4	5.7	,,_	"	1864.5	4
6 ·	148.1	18.9	0.9	0.5	,,	168.4	13
8	1245 2	4.7	0.5	0.1	,,	1250.5	3
3	2541.5	2.1	0.2	0.8	,,	2543.8	5
1	1490.5	0.5	"	0.8	"	1491.3	8
1	1836.0	0.5	,,	"	"	1836.5	4
• 6	2601.5	536.9	,,	,,	,,	8138.4	5
. 8	1114.9	134.2	"	,,	,,	1249.1	¦ 3
. 2	1734.6	59.6	"	"	,,	1794.2	4
1	743.8	14.9	,,	"	,,	758.2	2
•1	1982-1	14.9	,,	"	"	1997.0	4

Also
$$p. e. P._{0e} = \frac{1}{10^e} \sqrt{2064.6 + 169.5 + 13.6} = \frac{1}{10^e} \sqrt{2247.7} = 0.000047$$

$$p. e. P._{0e} = \frac{1}{10^e} \sqrt{1032.3 + 84.2 + 13.3} = \frac{1}{10^e} \sqrt{1129.8} = 0.000034$$

$$p. e. P._{0e} = \frac{1}{10^e} \sqrt{2064.6 + 84.2 + 70.0} = \frac{1}{10^e} \sqrt{2218.8} = 0.000047$$

SECTION IX.—Determinations of the Weights O, to O10 and also Prinsep's Bronze Troy Pound.

The comparisons of the weights from O₂ to O₁₀ have been made with the balance Oertling No. 2. Three complete comparisons were made in each case, and the weight P.₀₃ has been always used for valuing the scale. I have deduced the following equations of condition:—

$$\begin{array}{c} O_{s} \equiv O_{s} + O_{1} & -0.37200 \; P._{0.8} \equiv O_{s} + O_{1} \; 0.000000 - 0.37200 \; P._{0.8} \\ O_{4} \equiv O_{5} + O_{1} + P._{0.6} + 0.74542 \; P._{0.8} \equiv O_{5} + O_{1} + 0.060769 + 0.74542 \; P._{0.8} \\ O_{5} \equiv O_{3} + O_{5} + P._{1} \; + 0.37867 \; P._{0.8} \equiv O_{5} + O_{1} + 0.00085 + 0.37867 \; P._{0.8} \\ \equiv O_{4} + O_{1} + P._{0.8} + 0.60467 \; P._{0.8} \equiv O_{4} + O_{1} + 0.019881 + 0.60467 \; P._{0.8} \\ O_{1.0} \equiv O_{5} + O_{4} + O_{1} - P._{1} - P._{0.6} + 0.45742 \; P._{0.8} \equiv O_{5} + O_{4} + O_{1} - 0.160854 + 0.45742 \; P._{0.8} \end{array}$$

Whence I deduce by the Formulæ in Sec. VI.

In the last Section, I have given a general formula for finding a probable error of observation. In this case, I have Σ (o) = 3941·2 $\frac{P_{0.3}}{10^5}$, whence the probable error of one equation of condition will be

$$= 0.8454 \cdot \frac{3941.2}{\sqrt{3.2}} \cdot \frac{P_{.0.5}}{10^{5}} = 0.000413.5$$

The probable error of each determination of a weight depends—

1st, on its error derived from O₁ of which it is nearly a multiple,

2nd, on the error derived through the weights of the P set used to

nearly counterbalance,

3rd, on the error due to the fraction of P. o. which is involved in its determination,

4th, on the error generated in the weighings of the series. The following Table shows the error from each source separately.

Weights.	0,	Equil. Weights.	P.os	Weighments of Series.	Total.	Probable Error $\times 10^6$.
O ₂ O ₃ O ₄ O ₅ O ₁₀	52900 119025 211600 330625 1922500	5225 5225 11968 18624 47022	1179 449 2259 4747 47581	514116 685488 1199600 1713720 5826648	578420 810187 1425427 2067716 7813751	757 900 1194 1438 2795

In making these calculations, I have neglected to attend to the fact that the P weights used have a common origin; the sum of the squares of the probable errors given in the Table at the end of Section VIII is taken, and here (as will be seen by turning back) the error from their common origin O., is unfelt, but this is not always the case.

Among the weights in the Assay Office is a bronze Standard Troy Pound in a wooden case, on which case is stamped $\{ \begin{array}{c} J. \ \ FIELD \\ Fecit \end{array} \}$, and in ink is written

On the weight itself is engraved-

British Troy Pound.
= 5760 grains.
Royal Mint.

The surface of the weight is thinly oxidized, but it seems to be quite uninjured. I some time ago compared it, as well as I could, with the weights of the Gilt Troy set belonging to the Assay Office, which were supplied many years ago, and which were made by Bates in 1824. No record of any previous comparisons of these exists. The conclusion I came to was, that Prinsep's Troy Pound was about a mean of all the Gilt Pounds, the latter weights having sensible errors. I have then thought it worth while to determine the value of the Prinsep's Pound, and I find— $Prinsep's Pound \equiv O_{10} + O_{2} + P_{1} + P_{\cdot 01} - 0.487 P_{\cdot 03}$

= 5760.148354 grains,

from a single complete comparison.

To find the probable error of this we must substitute in the above equation the symbolic values of $O_{10} + O_{2}$ and thus we have—

Prinsep's Pound $\equiv 12 O_1 + P_{.01} + 4 P_{.03} + 4 P_{.06} - 3 P_{.1} + 4 23606 P_{.03}$ from which the probable error will (when the errors generated in determining O_3 and O_{10} , and also in the single comparison of this weight are allowed for)

$$=\frac{1}{10}$$
 $\sqrt{8878998}$ $= 0.002890$

and we may consider Prinsep's Pound = 5760:148 ± 0:003 grains.

SECTION X.—Considerations as to the Weights which should be made use of in a series.

The only generally used decimal system of weights, is the metric, which is so largely diffused. In it the weights between W₁ and W₁₀ are W₅, W₂ in duplicate, and W₁. When the system was adopted in England permissively, the intermediate weights chosen were W₅ W₅ and W₂. The other series in use, are those I have described before as the Bullion, and the English Grain Series. In making a series of weights of tolahs for the use of the Indian mints, I have therefore a choice; and it is worth considering which series is the best.

Commercially, the fewer weights required to make any weighment, the better. I think, too, that commercially it is undesirable to have duplicate weights, and of course none should be superfluous. In the strict French Metric system there are 3 weights required to weigh 9 and 8, while two are wanted for 7, 6, and 3, and the 2 is in duplicate; and in the English modification there are 3 weights wanted for 9 only, while 8, 7, 6, and 4 require two each, and there is no duplicate: I think then that the English modification is preferable to the original system.

In our *English Bullion* system there are never 3 weights wanted for any purpose; and 9, 8, 7, and 6 require two weights. But there are more weights than are wanted, there being 5 weights in each decad instead of 4.

In the *English Grain* system there are never 3 weights wanted; 9, 8, 7, 5. and 4 require two each, there are no duplicates, and none superfluous. I think then that the English Grain system is the best for commercial purposes.

Scientifically, the best system is that of which the values can be most accurately deduced from the standard Prototype. It is worthy of note, that neither of the Metric systems, nor the English Grain system, admit of the weights of a decad being completely determined without a second unit in each decad.

This is not an unmixed disadvantage. The 1, 10, &c., being necessary for this purpose only, and not used in common, may be kept separately, and referred to for verifications whenever desired, and by such use the errors of the weights of any decad, can be determined with comparatively little labour and without its being necessary to refer back to a primary weight. Thus, checking becomes much more manageable, and, by such a plan as I have adopted in dealing with the P set, one of the duplicates is far more accurately determined than the other, and can be laid aside for reference; the accuracy of the second being ordinarily sufficient.

The English Bullion system, as we have seen, contains the means of determining the values of all the weights without duplicates, and it is possible to have one weight practically unused, if we consent to make either 8 or 9 by three weights; this reference weight, however, is not so convenient for use as in the other cases.

The English Grain system has this advantage over all the others, that any weight from 1 to 10 requires at most two weights to make it. It has the disadvantage that 6 is not the half of ten, but, on the other hand, 3 is the half of 6; and I do not see the great gain of this relation, unless it be admitted that the system of division should be binary. In France, it was proposed that each multiple of a unit by ten, and each division by ten, should be a new unit. Some slight gain might have come if this had become a thoroughly practical procedure; but, in fact, one rarely hears of any but the kilogramme, gramme, and milligramme, and so of the other numbers of the series. I think, then, that the advantage of being able to have a single weight for half a hectogramme, &c. is dearly purchased, if there be a disadvantage in the determinations; and, in deciding on a system of weight, it is necessary to consider the probable errors of these determinations.

In each of these proposed systems, 5 comparisons, giving 5 equations, are enough to connect all the weights in a decad. If this number be alone used, then the probable errors of W_{1,0} derived from W₁ will be

English	Grain S	ystem	e	$\sqrt{24}$	
,,	Bullion	•••••	e	√ 34	if the best equa- tion be taken.
"	Metric		в	√ 38	
Origina	l Metric	•••••	в	√ 26	

In this respect the English Grain system seems best, and the Modified Metric System the worst. The Original Metric system is nearly as good as the English Grain system, and it is possibly better if a good deal more labour be given to each; but I think—when it is considered that weighing by the English Grain system requires only two weights in each decad, and that the standard system should coincide if possible with that in use—the palm will be assigned to the Grain system.

I think, too, that those who have gone with me so far, will feel as strongly as myself the great gain of a "large primary unit." It has

always been considered necessary to have the primary unit very indestructible, and no doubt this is a very important point: the lead was taken in France, where the Normal Kilogramme was made of platinum; platinum was again used in England for the Standard Pound, and now standards of reference are made of a Platinum-iridium alloy. The cost of the mere metal is very heavy (a kilogramme is at present worth £60 for mere material), and the use of such a metal for large weights is of course out of the question. It seems to me doubtful whether equal accuracy could not be obtained by employing a large weight of gilt or nickelized bronze; from which copies could be made with far greater accuracy than they could be separately deduced from the small primary. It is possibly too late to change the material of Primary Standards now, but at all events the standard of Commercial Weight should be a large mass of gilt bronze.

Acting on these principles, I have nearly made a set of weights from 1000 tolahs to 0.001 tolah from these bullion weights. There will be several copies of the largest, carefully compared, some of which I trust Government will allow me to distribute. The individual weights are on what I have called the English Grain system: that is, there are—

1000 tolahs. 100 tolahs. 10 tolahs. 1 tolahs. 0 10 tolahs. 0 010 tolahs.

The final adjustments and deductions have yet to be made; but after what I have said, there will be little new in this. I have been very greatly assisted by Mr. Durham, Senior Assistant in the Assay Office, who has superintended all of the gilding; and to whom I owe devices which will allow the gilt weights to be made true almost to the accuracy of a single comparison by substitution.

TABLE I.

Logarithms for calculating the Weight of the Air adapted to Fahrenheit's Thermometer.

This Table gives 10 + the logarithm of the ratio which the weight of air at the temperature named and at Calcutta bears to that of the same volume of water when at its maximum density, the logarithm of the height of the barometer.

If B be the reading of the barometer reduced to freezing point; the temperature and V the elasticity of the vapour in the air

then log sq. of air = $A_t + \log (B - 0.238 \text{ V})$.

The value of A_t at sea-level in latitude 45° can be got from these numbers by adding 0.000785.7 to each and thence the value for any other place.

Temp.	At.	Δ ⁽¹⁾ A _{t.}	Temp.	AŁ	Δ ⁽¹⁾ A _{t.}	Temp.	At	Δ ⁽¹⁾ A Ł
30°	5.6366164	8848	55°	5.6150200	8419	80°	5.5944469	8030
1	6357316	8830	6	6141781	8402	1	5936439	8015
$3\overline{2}$	6348486	8812	7	6133379	8387	2	5928424	8000
8	6339674	8794	8	6124992	8371	3	5920423	7985
4	6330880	8776	9	6116621	8354	4	5912438	7971
35	5.6322104	8759	60	5.6108267	8338	85	5.5904467	7957
6	6313345	8741	1	6099929	8323	6	5896510	7942
7	6304604	8724	2	6091606	8306	7	5888568	7927
8	6295380	8705	3	6083300	8291	8	5880641	7913
9	6287175	8689	4	6075009	8275	9	5872728	7899
4 0	5.6278486	8671	65	5.6066784	8258	90	5.5864829	7884
1	6269815	8654	6	6058476	8244	1	5856945	7870
2	6261161	8637	7	6050232	8227	2	5849075	7856
3	6252524	8619	8	6042005	8212	8	5841219	7841
4	6243905	8603	9	6033793	8197	4	5833378	7828
45	5.6235302	8585	70	5.6025596	8181	95	5.5825550	7813
6	6226717	8569	1	6017415	8166	6	5817737	7799
7	6218148	8552	2	6009249	8151	7	5809938	7785
8	6209596	8535	8	6001098	8135	8	5802153	7772
9	6201061	8518	4	5992963	8120	9	5794381	7757
5 0	5.6192543	8502	75	5.5984843	8105	100	5.5786624	İ
1	6184041	8485	6	5976738	8090		1	
2	6175556	8468	7	5968468	8074		Į.	1
8	6167088	8452	8	5960514	8060	l	1	1
4	6158636	8436	9	5952514	8045		l	

TABLE II.

Logarithm of the Ratio of the Density of Water to its Maximum Density for each degree of Fahrenheit's Thermometer.

This Table is founded on that given at page 66 &c. of the Report of the Warden of the Standards for 1871-72. Certain values of the Table there given, were taken and the constants found to express them in a series of the form A $(t-n_1)^2 + B(t-n_2)^3$, and, these having then been suitably modified to change the scale of the thermometer from Centigrade to Fahrenheit, the present Table was computed.

Temp.	Log. Ratio.	Δ(1) R.	Temp.	Log. Ratio.	Δ(1) R.	Temp.	Log. Ratio.	Δ(1) R.
30°	ļ		55°	0.0002400	+302	80°	0.0014313	639
1			6	0002702	318	1	0.0014952	650
2	0.0000546	143	7	0003020	335	2	0015602	659
3	0000404	-121	8	0003355	850	8	0016261	670
4	0000283	— 99	9	0003705	367	4	0016931	679
3 5	0.0000184	— 78	60	0.0004072	881	85	0.0017610	688
6	0000106	56	1	0004453	397	6	0018298	698
7	0000050	— 35	2	0004850	412	7	0018996	706
8	0000015	15	3	0005262	426	8	0018702	715
9	0000000	+ 06	4	0005688	441	9	0020417	723
4 0	0.0000006	+ 27	65	0.0006129	455	90	0.0021440	732
1	0000033	47	6	0006584	469	1	0021872	739
$\tilde{2}$	0000080	66	7	0007053	483	2	0022611	747
8	0000146	86	8	0007536	497	3	0023358	754
4	0000232	105	9	0008033	509	4	0024112	762
45	0.0000337	124	70	0.0008542	523	95	0.0024874	768
6	0000461	144	1	0009065	535	6	0025642	775
7	0000605	162	2	0009600	54 8	7	0026417	782
8	0000767	180	3	0010148	560	8	0027199	787
9	0000947	198	4	0010708	572	9	0027986	794
50	0.0001145	216	75	0.0011280	584	100	0 0028780	
1	0001361	234	6	0011864	596		2220.00	
$\hat{2}$	0001595	251	7	0012460	607			
3	0001846	269	8	0013067	617			
4	0002115	285	9	0013684	629			

TABLE III.

Logarithms for facilitating the Calculation of the Cubical Expansion of Metals.

Log. (1 + EM)	ſŧ.)
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	G = M Gold — 839·14	S = M Silver 441·41	'	B = M Baily's metal — 394-98.	Br = M Brass — 398·27
1	0 000010598	0.000013794	0 000006510	0.000012343	0-000012446
2	21196	27588	13020	24686	24892
8	81794	41882	19530	87029	37838
4	42392	55176	26040	49372	49784
5	5299 0	68970	82550	61715	62230
6	63588	82764	89060	74058	74676
7	74186	96558	45570	86401	87122
8	84784	110352	52080	98744	99568
9	95382	124046	58590	111087	112014

This table is founded on the supposition that up to 100° of Fahrenheit's Thermometer; log expansion for $n^{\circ} = n \times \log$ expansion for 1°; which is true sufficiently. The linear expansions of Gold and Silver have been taken from Vol. I of Professor Miller's Chemistry; the others from the paper in the 'Philosophical Transactions' on Standard Weights.

The argument of this Table is to be T — 32°; or T itself can be taken if the number at the head of the column be applied.

Thus for brass at 85.35° we have

Br 50°	0.000622.30	or Br 80°	0.000995.68
3	37·34	5	62.28
0.3	8 ·78	•3	8.73
0.05	0.62	.05	0.62
		Const.	— 398·27
-	0.000663.99	•	0.000663.99

J. F. Tennant-On Standard Weights.

TYPE COMPARISON I.

May 24th, 1879.

Oertling, No. 1.

Comparisons of EI with O1.

Weight	Weight		ALE INGS.	Deduced Mean.	Remarks.
on left side.	on right side.	Low.	High.	mean.	
EI	$O_1 + 1.2 \frac{R_s}{10}$	5·7 6·1	9·5 9·2	7.54	h. m. Commenced at 6.48 A. M. in. A. Bar. 29.60. Temp. 85.0 F.
EI + P.,0	Do.	13·6 13·7	18·0 17·8	15:81	Dry Bulb 85.9. Wet Bulb 81.0.
0, + P.,	$EI + 1.2 \frac{R_s}{10}$	18·1 18·4	17·4 17·2	15 21	
0,	Do.	3·4 3·8	10 7 10·3	6.95	
Do.	Do.	3·4 3·8	10·0 9·6	6.60	
0, + P. o 1	Do.	18.8 18·6	16·6 16·3	15.03	
EI + P.o.	$O_1 + 1.2 \frac{R_s}{10}$	12·8 13·3	18·9 18·5	15:99	
EI	Do.	3·6 3·0	11.9 11 [.] 4	7:61	Bar. 29 61. Temp. 86 0 F. Dry Bulb. 85 4 Wet Bulb 80 1.
	<u> </u>		<u> </u>	<u> </u>	Ended at 7.33 A. M.

Hence EI
$$\triangle O_1 + 1\cdot 2\frac{R_s}{10} - \frac{2\cdot 46}{8\cdot 27}P_{\cdot o_1} \triangle O_1 + 1\cdot 2\frac{R_s}{10} - 0\cdot 297P_{\cdot o_1}.$$

EI $\triangle O_1 - 1\cdot 2\frac{R_s}{10} + \frac{3\cdot 05}{8\cdot 26}P_{\cdot o_1} \triangle O_1 - 1\cdot 2\frac{R_s}{10} + 0\cdot 369P_{\cdot o_1}.$

EI $\triangle O_1 - 1\cdot 2\frac{R_s}{10} + \frac{3\cdot 40}{8\cdot 43}P_{\cdot o_1} \triangle O_1 - 1\cdot 2\frac{R_s}{10} + 0\cdot 40\cdot 4P_{\cdot o_1}.$

EI $\triangle O_1 + 1\cdot 2\frac{R_s}{10} - \frac{2\cdot 39}{8\cdot 38}P_{\cdot o_1} \triangle O_1 + 1\cdot 2\frac{R_s}{10} - 0\cdot 285P_{\cdot o_1}.$
 $\therefore 4 \text{ EI} = 4 O_1 + 0\cdot 191P_{\cdot o_1} : \text{ or EI} = 0_1 + 0\cdot 0\cdot 4775P_{\cdot o_1}.$

Note.—In the original the succession of observations has been distinguished, but want of space rendered it necessary to give this up.

Type Comparison II.

June 5th, 1879. Oertling No. 1. Comparisons of O_1 with $O_{\cdot s} + O_{\bullet} + O_{\cdot 1} = S$.

	Comparisons of	O ₁ wit	п О. в т	F U ₄ + U.,	1 - 0.
Weight	Weight		ALE DINGS.	Deduced Mean.	REMARKS.
on lett side.	on right side.	Low.	High.	Mean.	
$O_1 + 5\frac{R_1}{10}$	$S_1 + 4.2 \frac{R_2}{10}$	6·6 6·3	10·2 10·0	8.84	
$O_1 + 6\frac{R_1}{10}$	Do.	13·0 18·4	19·0 18·6	15.90	
$8 + 0.6 \frac{R_1}{10}$	$O_1 + 4.2 \frac{R_s}{10}$	3·3 8·0	10·6 10·3	6.88	
$8 + 1.6 \frac{R_1}{10}$	Do.	11·0 11·4	17·6 17·2	14:40	
Do.	Do.	9·9 10·4	19.4 18·8	14 49	
$8 + 0.6 \frac{R_1}{10}$	Do.	4·1 4·4	9·7 9·4	6.98	
$O_1 + 6\frac{R_1}{10}$	$8 + 4.2 \frac{R_{\bullet}}{10}$	12·8 13·1	17·9 17·4	15.40	
$O_1 + 5\frac{R_1}{10}$	Do.	6·0 6·2	9·6 9·9	7.99	
Hence O ₁ $ riangle$	$8 + 4.2 \frac{R_s}{10} -$	(5.0 +	$\left(\frac{1.66}{7.56}\right)$	$\frac{R_1}{10} = 8 +$	$4.2\frac{R_{2}}{10}$ — 0.5226 R,
0, 4	$8 - 4.2 \frac{R_s}{10} +$	(0.6 +	$-rac{3\cdot 12}{7\cdot 52}$	$\frac{R_1}{10} \simeq 8$	$4.2\frac{R_{\bullet}}{10} + 0.1015R_{\bullet}$
	TR.	/	8.02\	R.	R.

Hence
$$O_1 \triangleq S + 4.2 \frac{1}{10} - \left(5.0 + \frac{1}{7.56}\right) \frac{1}{10} \triangleq S + 4.2 \frac{1}{10} - 0.5226 R_1$$
.
 $O_1 \triangleq S - 4.2 \frac{R_s}{10} + \left(0.6 + \frac{3.12}{7.52}\right) \frac{R_1}{10} \triangleq S - 4.2 \frac{R_s}{10} + 0.1015 R_1$.
 $O_1 \triangleq S - 4.2 \frac{R_s}{10} + \left(0.6 + \frac{3.02}{7.51}\right) \frac{R_1}{10} \triangleq S - 4.2 \frac{R_s}{10} + 0.002 R_1$.
 $O_1 \triangleq S + 4.2 \frac{R_s}{10} - \left(5.0 + \frac{2.01}{7.41}\right) \frac{R_1}{10} \triangleq S + 4.2 \frac{R_s}{10} - 0.5272 R_1$.
 $\therefore 4 O_1 \equiv 4 S - 0.8481 R_1 \text{ or } O_1 \equiv O_{-8} + O_{-4} + O_{-1} - 0.212025 R_1$

TYPE COMPARISON III.

October 22nd, 1879. Oertling No. 2. Comparisons of O_s with $O_1 + O_4 + P_{\cdot o_3} = S$.

Weight on left side.	Weight on right side.		ALE DINGS.	Deduced Mean.	Remarks.	
Oli lett side.	on right side.	Low.	High.	mean.		
s	O _s	9 5 9 9	14·1 13·8	11.91		
8 + P.o.s	Do.	15·0 15·5	22·7 22·2	18.73		
O ₅	S + P	12 0 12·2	14·6 14·3	13.34		
Do.	S	16·3 16·7	28·0 22·6	19.55		
Do.	Do.	16·1 16·6	23·3 22·8	19.58		
Do.	S + P	12·2 12·4	14·1 14·0	18:21		
S + P. ₀ ,	O ₅	15·4 15·7	21·0 20·7	18·13		
ន	Do.	10·8 10·9	13·0 12·8	11.91		

Hence
$$O_s riangleq S + \frac{3 \cdot 09}{6 \cdot 82} P_{\cdot 0.8} riangleq S + 0.453 P_{\cdot 0.8}$$
.

$$O_s riangleq S + \frac{4 \cdot 55}{6 \cdot 21} P_{\cdot 0.8} riangleq S + 0.732 P_{\cdot 0.8}$$
.

$$O_s riangleq S + \frac{4 \cdot 58}{6 \cdot 21} P_{\cdot 0.8} riangleq S + 0.737 P_{\cdot 0.8}$$
.

$$O_s riangleq S + \frac{3 \cdot 09}{6 \cdot 22} P_{\cdot 0.8} riangleq S + 0.497 P_{\cdot 0.8}$$
.

$$\therefore 4 \cdot O_s = 4 \cdot S + 2 \cdot 419 P_{\cdot 0.8} \text{ and } O_s = S + 0.60475 P_{\cdot 0.8}$$
.

$$= O_1 + O_4 + P_{\cdot 0.8} + 0.64475 P_{\cdot 0.8}$$
.

P. S. June 29th, 1880.—After the earlier part of this paper was drafted, I learnt that M. St. Claire Deville had proposed to make standards of the Commercial Kilogram in a new manner. The metal is to be the Platinum-iridium alloy so as to secure hardness and indestructibility, but, in order that the density may be nearly that of brass, it is to be hollow, the parts are to be soldered together by fusion so as to enclose a constant mass of air, which, of course, will be included in the weighings. This plan has been adopted by the International Commission for making the European Metric Standards, and will no doubt be a great improvement on the old Commercial Standard of France, which is made of brass. The volume of these weights is to be 125 cubic centimetres, so that the density will be 8.0; which is a little lower than that of good sound weights of brass, and materially lower that that of gilt bronze; while it is greater than that of iron.

Certainly, the visible Commercial unit, to which reference can be made, appears preferable to the imaginary unit of England. Such a weight would vary in Calcutta with respect to the scientific unit to the extent of about 11 milligrams, and it would be needless to take notice (for commercial purposes) of the much smaller variations with respect to such weight as may be compared with it.

VI.—On the High Atmospheric Pressure of 1876-78 in Asia and Australia, in relation to the Sun-spot Cycle.—By HENRY F. BLANFORD, Met. Rep. to the Govt. of India.

(Received December 24th, 1879; Read January 6th, 1880.)
(With Plate I.)

The three years 1876, 1877, and 1878, more especially the two former, were characterized by a deficiency of rainfall in one or many parts of India, and by a more general and very persistent excess of atmospheric pressure. With but slight and local interruptions, from August (in some parts of India from May) 1876 to August (in some cases only to May) 1878, over the whole of the Indian area, the barometer ranged above the average of many years. Nor was this excess of pressure restricted to the land. The register of Port Blair at the Andaman Islands, and that of Nancowry at the Nicobars, shew that, at these insular stations, the excessive pressure was of greater duration and more persistent and intense than at any continental station at or near the sea-level; indeed, with one striking exception, more intense than at any other station in the entire region. At these islands, the pressure rose above the average in May 1876; and, from that time to August 1878 inclusive, the mean pressure of every month was from '004" to '071" in excess of the average; derived, in the case of Port Blair

from eleven, and, in that of Nancowry, from six years' registers. On the mean of the whole period and of the two stations, the excess amounted to .0327°.

The single exceptional station, which shews a greater average excess than the Bay islands, is the hill station of Darjiling in the Sikkim Himalaya, at an elevation of nearly 7000 feet above the sea. At this station, where the barometer has been registered steadily for upwards of 12 years, the mean excess of the same period of 28 months was not less than '0332": or, since the first rise took place in August 1876, the mean of the whole unbroken period of 25 months' excess was '0379". On the plains of Bengal, the mean excess (average of six stations) was only 0298 on the 28 months and '0354 on the 25 months, a reduction, as compared with Darjiling, which is probably explained by the fact that, in Bengal, as indeed generally in India, the mean temperature of the air was also on the whole considerably in excess of the average; so that the stratum of air resting on the plains had less than the average density. This fact is of pregnant importance; for it shews that the excessive pressure in question was due to the condition of the higher atmosphere; of those strata, at all events, that lay above the elevation of 7000 feet; and that, in fact, the prevailing excess, instead of being caused by the conditions recorded at observatories on the plains, was to some extent counteracted by a deficiency in the mass and static pressure of the lower strata.

In his report on the Meteorology of India in 1877, Mr. Eliot drew attention to the persistently high barometric pressure of that year, and pointed out that the barometric registers of Sydney and Melbourne in Australia also "indicated, on the whole, a marked tendency to excessive pressure; and that, therefore, there is a slight probability that this is a feature of the whole area, from India southwards to Australia, including the sea area of the Indian Ocean." Furthermore, that it appeared, from the register of Hongkong, "that the pressure in that part of China was as markedly and persistently in defect as it was in excess in India."

A re-examination of the data shews, however, that this latter conclusion is extremely doubtful, and indeed probably mistaken. I find that the Hongkong barometric registers of past years have been so variously treated that no trustworthy comparison can be instituted on them; and, on the other hand, I find that the excellent registers of Zi-ka-wei near Shanghai point to an opposite conclusion, and shew that here also, on the east coast of China, the pressure was excessive during the greater part of the period in question, though to a much less degree than in the Indian region.

In the case of Australia, Mr. Eliot compared the registers of Sydney and Melbourne only. I have examined that of Adelaide in addition, and find that not only does it confirm the general conclusion drawn from the two former registers, but, further, shews that in South Australia the excess

was more intense than at any other station yet examined either in Australia or India. At this station, the pressure rose above the average in May 1876 (as at the islands in the Bay of Bengal) and, with the exception of 4 months, remained in excess until June 1878; the average excess of the whole period being not less than '0681" or \(\frac{1}{16}\) of an inch of the barometer. At Melbourne, during the same period, it averaged '0387" and was less prolonged. For Sydney, I have registers only up to September 1878, and these shew an excess much below that of Melbourne. It would seem, therefore, that in Australia as in Asia the excessive pressure diminished towards the east coast of the continent.

As a link between the data of the Indian and Australian regions, I have the registers of Singapore and Batavia; for the latter of which I am indebted to the kindness of Dr. Bergsma. At Singapore, the same barometer has not been in use throughout. The barometer registered in 1869 and 1870 having been injured, was replaced by another in 1871 which had never been compared directly or indirectly with the former; and the relative values of the registers in the two former and subsequent years are, therefore, more or less open to doubt. The position of the instrument also has been changed once or twice; but, in comparing the registers of past years, I have applied an appropriate correction for the changes of level. The registers extend from May 1869 to the present time. According to these, during the four and a half years, from May 1869 to October 1873, and certainly from July 1871, in only two months, was the mean pressure of any month slightly above the general average of the month, as deduced from the whole series of years; whereas, from November 1873 to February 1875 (16 months in all), ten months ranged above it, and six only below it; and from March 1875 to June 1878, every month shews an excess, excepting April 1876 (which was the same as the average) and November 1876 and December 1877, which were slightly below it. Hence, it appears that the excessive pressure began earlier and was more prolonged at Singapore than at any other station yet examined; but it was less than half as intense as at Adelaide; the average of the 26 months, May 1876 to June 1878, being only '0293".

The register of Batavia affords evidence very similar to that of Singapore. Here also from November 1869 to August 1878, a period of 3 years and 10 months, in only four months did the pressure range slightly above the average; from the latter date to April 1876, in ten months it exceeded the average; and from May 1876 to August 1878, it was above the average in every month except three. The average excess of this period was 0256. Thus, at these two sub-equatorial stations, there is evidence of a gradual rise of atmospheric pressure since 1870; and the Batavian register recorded under the careful superintendence of Dr. Bergsma is of the highest validity.

In Ceylon and Southern India, the excessive pressure was of shorter

duration than at the Bay islands, and on the average of the whole period not more than half as great; viz., '020'.

As far as can be judged, then, from the available evidence, the excess appears to have been greatest (in the Indian region) on an axis lying between the Nicobars and Bengal. And, in Australia, at Adelaide, or possibly to the westward of that station. In the absence of any sufficient registers for Western Australia, this must remain an open question. To the eastward, however, it certainly diminished greatly at Melbourne, and still more at Sydney. Whether, however, the condition of excessive pressure was continuous between Batavia and South Australia or otherwise, there is no distinct evidence to show.

In Asia, the excess was less in Assam than in Bengal, and was comparatively small at Shanghai (Zi-ka-wei). To the westward, it also diminished, but not quite regularly; since, in Orissa and on the Gangetic plains, it was less than on the plateaux of Chutia Nagpur and Bundelkand, and slightly less than in Rajputana and Sind. Some of these irregularities probably depend on variations of the temperature, and therefore density, of the lower atmosphere; and partly also are apparent only, and owing to the fact that the averages which have served as the standard of the comparison are derived, in some cases, from longer series of years than in others. That, notwithstanding these irregularities, there was, on the whole, a general decrease of the excessive pressure to the westward of the axis above defined, appears, however, pretty clearly, from the following average values of this excess for the whole period of the 28 months of its duration.

It may here be observed that this axis or ridge of greatest intensity, if prolonged, lay across the middle of the two great continental masses, Asia and Australia, from Western Siberia to South Australia; a position which suggests the probability that the phenomenon was in some measure dependent on the presence and position of these large land masses.

The variation of the anomalous pressure from month to month, at all the stations above referred to, is given in the accompanying Table I, which shows the deviation of the pressure, in each month, from the average of that month and place (or district), as derived from the registers of many years.

TABLE I.—Deviation of pressure in each month from the

				Punjab.	Gangetic plain.	Bundelkand, &c.	South Central Provinces and Berar.	Dakhan and Mysore.	East Coast and Carna- tic.
1876.	April,	•••	•••	•045	—·054	033	•055	 043	— ·054
	Мау,	•••	•••	·045	—∙046	—∙037	·043	018	 ·029
	June,	•••	•••	008	—·012	+ .008	 ∙003	002	·008
	July,	•••	•••	037	048	•049	041	026	025
	August,	•••	•••	+ '004	+ •005	+ .012	o	+ .005	015
	September,	•••	•••	+ '024	+ '014	+ .016	+ .010	+ 020	— ·001
	October,	•••	•••	+ .034	+ .044	+ .044	+ .042	+ 028	+ -022
	November,	•••	•••	008	— ·015	004	004	009	—·004
	December,	•••	•••	+ .051	+ .034	+ .042	+ .044	+ .032	+ .044
1877.	January,	•••	•••	+ .067	+ .067	+ .069	+ .059	+ 030	+ '056
	February,	•••	•••	+ .024	+ .052	+ .054	+ .031	004	+ -021
	March,	•••	•••	+ .012	+ '024	+ .033	+ .029	+ .005	+ -026
	April,	•••	•••	+ .058	+ .060	+ .065	+ .050	+ .025	+ -045
	May,	•••	•••	+ .030	+ .025	+ .055	+ .033	+ .010	+ '019
	June,	•••	•••	+ .032	+ .037	+ .038	+ '034	+ .026	+ .033
	July,	•••	•••	+ '011	+ .012	+ .040	+ .057	+ .054	+ -038
	August,	•••	•••	022	027	005	+ .011	+ 032	+ '022
	September,	•••	•••	+ .020	+ .018	+ .051	+ .060	+ .028	+ -045
	October,	•••	•••	+ '043	+ .048	+ .023	+ .060	+ .033	+ .067
	November,	•••	401	+ .014	+ .008	+ .016	+ .041	+ .032	+ 031
	December,	•••	•••	008	— ∙007	·004	+ .002	+ .003	+ .009
187 8.	January,	•••	•••	+ .031	+ .032	+ .044	+ 018	+ .011	+ -030
	February,	•••	•••	+ .030	+ .028	+ '034	+ .028	+ .038	+ .046
	March,	•••	•••	+ •040	+ '043	+ .062	+ .084	+ .031	+ 046
	April,	•••	•••	+ .022	+ .041	+ .050	+ .035	+ .027	+ 038
	May,	•••	•••	+ .029	+ •050	+ .048	+ .023	+ .012	+ -023
	June,	•••	•••	+ '014	 ·0 07	+ .020	+ •006	010	— ·008
	July,	•••	•••	+ .034	+ .033	+ .035	+ .012	— 1015	005
	August,	•••	•••	+ .018	+ .019	+ .003	014	030	009
	September,	•••	•••	 ∙039	031	023	041	039	·028

average of the month and place.

Orissa.	Lower Bengal.	Darjeeling.	Assam and Cachar.	Arakan.	Bay Islands.	Singapore.	Batavia.	Rajputana and Sind.
 ∙062	—·052	.010	-040	.044	.000		— ·037	·040
— 002 — 037	— ·017	016	 ∙048	044	023	+ .033	+ .008	—·025
003	+ 014	- ·005 + ·004	002	012	+ ·025 + ·023		+ '001	+ '002
050	—·045	018	002	+ *012	+ .023	+ '030	+ .009	-·047
 ·017	+ .005	+ .025	·03 <i>5</i>	·027 ·010	+ .009	+ .023	003	+ '002
- 017	+ .014	+ .046	+ .003	+ 013	+ .033	+ '025	+ .003	+ .030
+ 022	+ 047	+ .060	+ .058	+ 018	+ .034	+ .040	+ .015	+ .036
036	- 029	+ 000	 029	030	+ .008	-·014	+ '004	+ .009
+ .034	+ .028	+ .043	+ .030	+ .042	+ 049	+ .037	+ .033	+ .038
+ 064	+ 065	+ .107	+ 084	+ .073	+ .066	+ .060	+ .054	+ 054
+ .062	+ 072	+ 031	+ .065	+ 060	+ .089	+ .043	+ .047	+ .023
+ .034	+ .038	+ .029	+ .027	+ .044	+ .029	+ '026	+ .028	+ .014
+ .065	+ .070	+ .028	+ 061	+ .058	+ •034	+ .029	+ .030	+ .039
+ .041	+ .042	+ .019	+ .032	+ .037	+ .027	+ '020	+ .016	+ .047
+ .015	+ .032	+ .041	+ .022	+ 014	+ .049	+ .049	+ .051	+ '034
+ 032	+ .023	+ .015	001	+ .002	+ .045	+ .045	+ .057	+ .065
032	032	+ •012	— ∙037	040	+ .034	+ .054	+ .066	+ .044
+ .057	+ .058	+ .037	+ .051	+ .078	+ .056	+ .040	+ '054	+ .055
+ .062	+ .077	+ .066	+ .081	+ .082	+ .071	+ .049	+ .058	+ .032
+ .008	+ .008	+ .028	+ .017	+ .031	+ .042	+ .036	+ .033	+ '017
018	003	+ .011	·004	+ .016	+ .015	003	+ .008	— ·008
+ .019	+ •045	+ .021	+ .044	+ '054	+ .035	+ .012	+ .026	+ .038
+ .017	+ .030	+ .042	+ .035	+ .062	+ .046	+ .033	+ .021	+ 037
+ .036	+ .020	+ .068	+ .069	+ .073	+ .051	+ .036	+ .039	+ .041
+ .040	+ .055	+ 059	+ .058	+ .042	+ .032	+ .016	+ .012	+ .029
+ .032	+ .060	+ .029	+ .049	+ .032	+ .004	+ '002	002	+ .013
011	+ .015	+ .026	+ .011	+ .019	+ .007	+ .002	+ .006	+ .017
+ .024	+ .067	+ .056	+ .066	+ .071	+ .012	'014	022	+ .001
+ .003	+ .047	+ '047	+ .050	+ .061	+ .021	+ '014	+ '002	036
 ·042	023	 .009	028	 ·025	014	011	— ·015	040

Table I.—Deviation of pressure in each month from the average of the month and place.—(Continued.)

				Bombay.	Ceylon.	Zi-ka-wei.	Sydney.	Melbourne.	Adelaide.
1876.	April,	•••	•••	039	— ·039	037	—·167	- 094	— ·002
	May,	•••	•••	+ .009	-·003	+ .030	+ .072	106	+ '110
	June,	•••	•••	+ '026	+ .002	+ .018	+ 039	+ .043	+ '094
	July,	•••	***	 ·020	007	+ .021	+ '007	+ .097	+ 072
	August,	•••	***	+ .018	 ·007	016	+ '013	+ 048	+ 101
	September,	•••	•••	+ .034	+ .006	+ .043	—·061	+ 001	+ 100
	October,	•••	***	+ .045	+ .017	—·018	+ 120	060	— ·031
	November,	•••	***	- 004	013	—·071	—·191	 ·119	053
	December,		•••	+ .023	+ .028	+ .014	+ .035	+ .056	+ -077
1877.	January,		•••	+ .038	+ .045	+ .022	— ·051	+ '007	+ 040
	February,	•••		+ .027	+ .032	+ .036	+ .052	+ 026	+ 026
	March,	•••	•••	+ .025	+ .017	011	+ 061	+ .060	+ '057
	April,	•••	•••	+ .029	+ '027	— ·019	+ .024	+ .053	+ .079
	May,	•••	•••	+ .035	+ .017	+ .012	209	— ·152	—·112
	June,	•••	•••	+ .055	+ '057	+ .006	+ .196	+ .204	+ '285
	July,	•••		+ .097	+ '043	+ .002	+ .137	+ .163	+ 1090
	August,	•••	•••	+ .052	+ .050	+ .015	+ .065	+ .087	+ 118
	September,	•••	•••	+ .038	+ .040	+ 024	+ .077	+ .152	+ 162
	October,	•••	•••	+ '034	+ .060	+ .030		+ .121	+ 101
	November,	•••		+ .020	+ .029	+ 004		002	+ 081
	December,	•••	•••	015	003	008		+ .011	+ '063
1878.	January,	•••		+ .012	+ 020	+ .045		+ 125	+ 114
	February,	•••	•••	+ .043	+ .037	+ .079	-ਦ	+ .064	+ .092
	March,	•••	•••	+ .039	+ .032	+ .080	3ive	018	+ -013
	April,	•••	•••	+ .020	+ .026	+ .052	ğ	— ∙039	025
	May,	•••	•••	+ .025	+ .009	015	Not received.	+ .072	+ '104
	June,	•••	•••	+ .022	+ .007	001	74	099	+ '014
	July,	•••	•••	0	010	+ .020		—·155	 ·161
	August,	•••	•••	049	003	+ .038		— ·076	+ 1008
	September,		•••	·—·083	:009	-· · · · · · · · · · · · · · ·		—·115	—·133

Evidence bearing on the northern prolongation of the axis of maximum pressure across Central Asia (at least up to the end of 1877) is afforded by the old established observatories of the Russian empire; the registers of which, since 1847, are given in the 'Annales de l'Observatoire Physique Central de Russie'. Before, however, proceeding to notice the barometric condition of this region during the special period in question, I must draw attention to another class of facts, which have an important bearing on the subject, and which, although not entirely new, have been brought out in the present investigation with remarkable clearness and prominence.

I have already noticed the evidence furnished by the registers of Singapore and Batavia, of a persistently low pressure from 1869 to the latter part of 1873, of its gradual rise during the subsequent years, and its culmination in 1877. The Batavian register extends as far back as 1866: comprising, therefore, a period of 13 years, and somewhat more than a complete cycle of sun-spot variation. The deviation of the mean pressure of each year from the general average of the whole period is given in the second column of Table II; and, in the first, I have given the variation of Wolf's sun-spots numbers up to 1875, the latest date for which I have them. I need only add that from 1875 to the early part of the present year, was a prolonged period of minimum solar activity. The coincidence of the barometric variation with that of the sun-spots is too obvious to need comment; and it is emphatically to be noticed that the minimum of pressure coincides with the maximum of spots, and vice versa. The remaining columns of the table give the annual deviation of the mean pressure of each year from the general local averages, for the stations Singapore, Port Blair, Colombo, Akyab, Chittagong, Calcutta, and Darjiling, from 1867 to 1878; and the accompanying plate represents graphically the course of variation at each station from year to year. All these exhibit, more or less distinctly, an oscillation similar to that of Batavia; being most pronounced at insular and sub-equatorial stations. Table III gives the annual barometric variation of Calcutta and Bombay from 1848 and 1852 respectively, and Plate I, the corresponding curves.

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TABLE II.—Annual variation
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TABLI

				•		-						-	•
	(1) Last eight months.	(2) Last six months.	(3) January, February and last six	montals.	(4) Wanting rebruary and December.	(5) Wanting January.	(6) Last six months only.						
Вошрау.	+ -015	+ .027	+ -006	012	7 00.—	014	010	011	0	400. +	+ .037	011	
Darjiling.	(9)	017	019	600.	400.—	600. +	+ .001	+ .008	600. +	900. +	+ .086	+ .012	_
Calcutta.	220· +	+ .022	900. +	011	900.	+ 004	900	+ .002	800.	600-	+ 044	+ .014	
Chittagong.	410.—	610.—	610.—	970.—	800.	001	400. +	+ .023	+ .002	- 003	+ 089	+ .023	
A kyab.	600. +	6 00. +	+ ·012	- - - - - - - - - - - - - - - - - - -	013	017	120.—	+ .001	800.	600.	+ .036	+ .012	_
Port Blair.	:	+ -029	900. +	-042	(E) (E) (E) (E) (E) (E) (E) (E) (E) (E)	020-	013	400.—	900	+ .010	+ .052	+ .010	
Colombo.	:	:	i	:	:	- 020	002	+ .003	1 00. –	+ .002	+ .087	0	
.eroqagni8	i	: 5	(T) — 018	450	- 99.	023	410.—	+ .018	+ .018	+ -019	+ .087	700.	_
Batavia.	900. +	+ .020	+ -011	සු . –	600. –	020.—	- 010	900.	011	002	+ :042	100.—	
Wolf's sun-spot	8.8	8.98	78.6	131.8	113.8	2.66	2.29	48·1	18.9	:	:	i	
Years.	1981	89,	99	02,	12,	772	.73	,74	32,	,76	11.	178	

TABLE III.—Annual variation of	pressure at Calcutta as	d Bombay.
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Years.	Calcutta.	Bombay.	Years.	Calcutta.	Bombay.
1847 '48 '49 '50 '51 '52 '53 '54 '55 '56 '56	 018 002 + 005 0.14 013		1858 '59 '60 '61 '62 '63 '64 '66 '66 '67		+ '008 + '004 - '005 - '012 - '026 - '017 + '028 + '002 + '013 + '015 + '027

From these facts, it may be concluded that, in the Indo-Malayan region, the pressure of the atmosphere is subject to a cyclical variation, coinciding in period with that of the sun-spots; and such that the epoch of maximum pressure corresponds to that of minimum sun-spots and that of minimum pressure to that of maximum sun-spots. When, however, we turn to Western Siberia, we find an oscillation, not less, nay, far more pronounced, and precisely of the opposite character; the maximum of pressure there coinciding with the maximum of sun-spots, and vice versa. The station which exhibits this most prominently, is Ekaterinenburg at the eastern foot of the Oural. But it is also very distinctly recognizable at Bogolowsk to the North, at Slatoust to the South-west, at Barnoul at the northern foot of the Altai, and, as Mr. Archibald pointed out some time since in the pages of 'Nature,' at St. Petersburg. The annual differences at these stations are given in Table IV, and the corresponding curves in the accompanying plate.

TABLE IV.—Annual variation of barometric pressure in Russia and Western Siberia.

	يد		i .			
Years.	Wolf's sun-spot numbers.	St. Petersburgh.	Bogolowsk.	Ekaterinenburg.	Slatoust.	Barnoul.
1847 '48 '49 '50 '51 '52 '53 '54 '55 '56 '57 '58 '59 '60 '61 '62 '63 '64 '65 '66 '67 '68 '69 '70 '71 '72 '73 '74 '75 '76 '77	97·4 124·9 95·4 69·8 63·2 52·7 58·5 21·0 7·7 5·1 22·9 56·2 90·3 94·8 77·7 61·0 45·2 81·4 14·7 86·8 78·6 131·8 113·8 99·7 43·1 18·9	+ · 045 + · 044 + · 003 - · 027 + · 036 - · 012 + · 065 - · 081 + · 008 - · 104 + · 064 - · 010 - · 022 + · 061 - · 005 + · 086 - · 049 + · 021 + · 018 - · 017 - · 071 - · 073 - · 017 - · 034 + · 023 - · 040 - · 040 - · 040 - · 040 - · 087 + · 051 + · 008	- · · · · · · · · · · · · · · · · · · ·	+ ·022 + ·049 + ·011 + ·006 + ·015 + ·065 - ·032 - ·023 - ·023 - ·023 - ·024 - ·046 + ·046 + ·046 - ·016 + ·006 - ·031 - ·034 - ·056 - ·052 - ·053 + ·008 + ·071 + ·030 - ·009 + ·016 - ·007 - ·007 - ·007	+ ·097 + ·078 + ·033 + ·037 - ·055 - ·118 - ·074 - ·019 - ·024 - ·069 + ·009 - ·010 + ·015 + ·028 - ·021 + ·023 + ·021 - ·036 - ·025 - ·035 + ·007 P · ·034 - ·060 - ·088 - ·080 + ·010	011 + 028 017 + 011 + 007 + 019 + 023 013 013 024 040 031 + 008 + 055 062 + 013 017 + 008 003 + 050 + 009 011 009 001 + 019 + 009 + 001 + 019 + 001 + 098

All these stations, be it observed, are in Western Siberia or European Russia; and it now becomes of interest to ascertain over what area this kind of oscillation obtains. To do this, I have tabulated the barometric data for Tiflis on the South-west, and Nertschinsk and Pekin on the East. No one of these stations exhibits characters resembling those of the stations in Western Siberia; and the curve of Pekin, which is fragmentary, seems rather to exhibit the Indo-Malayan type of variation than that of the Ural stations. Hence, it would seem there is a reciprocal oscillation of atmospheric pressure between Western Siberia and the Indo-Malayan region

(perhaps including China) having a period which coincides with that of sun-spot variation; and that Tiflis on the one hand and Nertschinsk on the other lie beyond the limits of its influence.

Now, seeing that the Indo-Malavan barometric maximum of 1876-78 coincided with a portion of the prolonged sun-spot minimum of 1876-79. the facts detailed above would lead us to expect a corresponding deficiency of pressure in Western Siberia. Strange to say, however, this was not the The registers of Bogolowsk, Ekaterinenburg, Slatoust, and Barnoul agree in showing a great excess of pressure in 1877, which in the case of Ekaterinenburg was greater than that of any Indian stations, and nearly as great as that of Adelaide. I have not yet received the volume of the 'Annales' for the year 1878; but, on the average of the 20 months from May 1876 to December 1877, it amounted to '0611." The great excess appears to have been restricted to the stations in Western Siberia. At St. Petersburg, although the pressure was above the average in 1876 and 1877, the excess was far less striking; and that of 1877 was less than that of 1876. At Tiflis, the pressure of the two years was either about the average or below it; and, at Pekin and Nertschinsk, it was not greater than at Shanghai [Zi-ka-wei].

Hence, there prevailed in Asia generally, in 1877, an anomalous (i. e., apparently non-periodic) accumulation of atmospheric pressure, culminating in Western Siberia, and diminishing both to East and West, and also to South. And this seat of maximum lies on the prolongation to the Northwest of the Indo-Malayan axis of excessive pressure noticed in the earlier part of this paper. It is at least probable that this anomalous accumulation of pressure extended in a much diminished degree to the Indo-Malayan region, where it was superimposed on the normal periodic excess of that region, and produced a maximum which was more intense than any previously recorded. Also that the excessive pressure of Australia was a phenomenon of the same order as that of Siberia; indeed its southern counterpart. It is at least certain that they exhibit a resemblance in certain not unimportant features to which I shall draw attention in a subsequent paper; merely remarking that, in both cases, these great oscillations of pressure, both periodic and non-periodic, appear to depend mainly, perhaps, indeed, entirely, on the variations of the winter season. Of this, in the case of Ekaterinenburg more especially, the evidence is most striking and convincing, and, as far as I have yet examined the Australian registers, it appears to hold good in their case also.

VII.—Synopsis of the Species of Choeradodis, a remarkable Genus of Mantodea common to India and Tropical America.—By J. Wood-Mason, Officiating Superintendent Indian Museum, and Professor of Comparative Anatomy, Medical College, Calcutta.

(Received May 1st; -Read June 2nd, 1880.)

The paper of which the following is an abstract, will be published in full as soon as the illustrations which have been drawn on the wood under my supervision and sent to London to be cut are returned to this country.

The remarkable distribution of this genus of *Mantodea* is exactly paralleled by that of another genus of *Orthoptera*, namely *Mastax*, species of which from the southern slopes of the Peruvian Andes have recently been described by Dr. S. H. Scudder.

The nearest allies of Chæradodis are the Australian Orthoderas, which its young 'larvæ' resemble in the form of the pronotum.

Genus CHOERADODIS, Serville.

A. Fore femora without a black blotch on the inner side.

1. CHOERADODIS STRUMARIA.

Madame Mérian, Ins. de Surinam, 1726, tab. 27, 2 et nymph. Roesel von Rosenhof, Der monatlich-herausgegebenen Insecten Belustigung, 2ter Theil, 1749, Locust. tab. iii, fig. 1 et 2, 2 et nymph (copied from Mérian).

-----, Stoll, Spectres et Mantes, pl. xi, fig. 42, Q.
-----, Lichtenstein, Trans. Linn. Soc. Lond. vol. 6, p. 25.

Charadodis cancellata, Serville, Hist. nat. des Orthopt. 1839, p. 206. 9.

Oraurusa cancellata, Burmeister, Handb. d. Entom. 1839, Band ii, p. 542, (Syn. Serv. et Stoll. fig. 75, exclus.)

Choeradodis cancellata, Saussure, Mant. Americ. p. 19, 5, 9.

HAB. Cayenne (2, Serville); Surinam (2, Mérian, Stoll; & 2, Saussure).

B. Fore femora with a black blotch on the inner side.

(a.) The blotch on the lower half of the joint (American).

In the females of the following two species, the posterior angles of the pronotal expansions are broadly rounded and are not produced backwards beyond the level of the hinder end of the primitive pronotum.

2. CHOERADODIS RHOMBICOLLIS.

Mantis rhombicollis, Latr. in Voy. de Humboldt, Zool., Ins. p. 103, pl. 39, figs. \$, \$, \$.

Choeradodis peruviana, Serville, Hist. nat. des Orthopt. 1889, p. 207, &.
——strumaria, Stäl, Syst. Mant., 1877, p. 15, 3 2.

The blotch commences, in both sexes, near the base of the femur, extends through the ungual groove nearly to the middle of the joint, and is there succeeded by a marginal row of black points in contact with the bases of alternate spines.

HAB. & ?, Guayaquil, in the collection of the British Museum; nymph, Santa Fé de Bogota, in the collection of the Indian Museum, Calcutta; New Granada (& ?, Stäl).

3. CHOERADODIS SERVILLEI, n. sp.

- Q. Closely allied to the preceding, from which it differs in having the marginal field of the tegmina proportionately narrower, and in the smaller size, as well as in the different shape, of the femoral blotch, which is small and oval, commences just beyond the ungual groove, and is followed by a marginal row of small black points.
- HAB. 2 2, Cache, Costa Rica, in the collection of Messrs. Godman and Salvin; nymph, Chiriqui, in the collection of the Indian Museum, Calcutta.

In the females of the next two species, and in all probability in those of *Oh. rhomboidea* also, the posterior angles of the pronotal lamellæ are rounded-angulate and produced backwards so that the hinder end of the primitive pronotum projects in the bottom of an angular emargination.

4. Choeradodis laticollis.

The blotch is situated, in both sexes, just beyond the ungual groove, is oblong-rhomboidal in shape, and is followed by two black points on the bases of alternate spines; there is a fuscous speck at the end of the stigmatal spot of the tegmina; and the antero-lateral margins of the pronotal lamellæ are arcuate or convex, especially in the female.

HAB. 5 &, 5 \, Ecuador (Buckley), in the collection of the Indian Museum, Calcutta; Peru (\, Stal); Cayenne (\, Serville et Stal); Surinam (\, Saussure).

5. CHOERADODIS STALII, n. sp.

Differs from the preceding in the shape of the blotch (which is pointed at both ends and commences in the ungual groove, and on either side of which the femur is pale luteous-yellow instead of being clouded with fuscous); in being without a fuscous speck at the distal end of the stigma; in its shorter and differently shaped facial shield; and in having the antero-lateral margins and the lateral angles of the pronotal expansions sinuous-concave and more broadly rounded off respectively.

HAB. 1 &, 4 ?, Ecuador (Buckley), in the collection of the Indian Museum, Calcutta.

6. CHOERADODIS RHOMBOIDEA.

Mantis rhomboidea, Stoll, Spectres et Mantes, pl. xi, fig. 45, 3.

The male insect from Pará, in the British Museum, agrees neither with Saussure's description (*loc. supra cit.* p. 18), nor with any of the specimens in the Indian Museum; it more nearly approaches Stoll's figure, agreeing therewith in the points in which it differs from them.

The blotch commences in the ungual groove, thence extending as far along the femur as in the preceding four species, but it is not followed by a marginal row of black points. The pronotal lamellæ have no posterior angles.

HAB. &, Pará, in the collection of the British Museum. A nymph, from Ega, in the same collection, probably also belongs to this species.

This species is nearest allied to Oh. laticollis.

(β) The blotch on the upper half of the joint (Indian.)

7. Choeradodis squilla.

? Mantis cancellata, Fabr. Ent. Syst. II, 1793, p. 18.

Choeradodis squilla, Saussure, Mél. Orthopt. t. i, 3me fasc. p. 161, pl. iv, figs. 3, 3a, 3 et nymph.

Lucas, Ann. Entom. Soc. Fr. 5 sér. t. ii, 1872, p. 32, Q.

HAB. India generally, from Ceylon (& et nymph, Saussure; larva, in I. M. Calc.); Madras (?, Lucas); Central India (in coll. Hop. Oxon.); to the banks of the Killing River, in the N. Khasi Hills, on the N. E. Frontier (nymph, A. W. Chennell).

Obs. A specimen of this species in the British Museum is erroneously marked "Brazil."

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VIII.—On the past and present Water supplies of Salcutta. ALEXANDER PEDLER, F. I. C., F. C. S., London and Berlin.

At the present day it is I believe universally acknowledged, that every town should be provided with a pure and sufficient supply of water for drinking, domestic and sanitary purposes. If the quantity be not sufficient or if the quality be not good, it may be safely asserted that injury. more or less profound, to the general health of its inhabitants will be the consequence. The very great importance which is attached to the quality and quantity of the water supply of towns, is clear from the prominence which this subject has attained throughout the civilized world during the past few years. In the present paper, it will be my purpose to contrast the nature of the water employed in Calcutta in former years (before the introduction of the present hydrant water) with the supply as it has been since the introduction of the Hooghly water, which is collected and filtered at Pultah, and then distributed by the hydrants, etc. It will be my endeavour to show that the old supply was deficient in quantity, and filthy and abominable in quality, whilst the present supply, though perhaps not so abundant in quantity as it ought to be, is in quality very good and wholesome.

Before proceeding to the discussion of the question of the two supplies, it will perhaps be well to consider what is the general history of natural waters, as this will enable us to understand some of the actual results which have been found by analysis.

The primary form of natural water is rain, and although at first sight it might appear that rain water should be very pure, yet it has been clearly shown* that it is very seldom that such is the case, and that rain water almost always contains, as impurities, small quantities of organic matter, ammonia, and ammonium salts, derived from the atmosphere. In large towns especially, the rain water is so impure, that it cannot be considered a safe water supply for drinking and other domestic purposes. On reaching the ground the water becomes charged to a greater or less extent with the various soluble constituents of the soil, and with any other matters which may have accumulated in it. If it falls on land either cultivated or uncultivated, it rapidly drains off, and finds its way into streams and rivers, which in the earlier parts of their course certainly, will be tolerably free from organic impurity, except that derived from any manure, etc. which may have been on the land. Unless the river water is subsequently rendered impure by the admission of sewage from towns, villages, etc., or by the admission of manufacturing refuse, it will form. generally speaking, a comparatively pure and wholesome supply of water. In some cases, however, such water is used by the inhabitants of towns on its banks, and is after use returned to the river in the form of sewage, which will be charged with impurity derived from animal excreta, household and manufacturing refuse, soap, and other filth. Water contaminated in such a way is clearly unfit for domestic use. After returning to the stream it will perhaps in its course towards the sea become partially purified by slow oxidation of the organic matter and by the absorbent action of vegetation, but as will be subsequently shown this process of purification is an extremely slow one.

In the case of rain water falling in towns such as Calcutta, it will, as pointed out previously, be impure from the presence of organic matter, ammonia, etc.; of this impure water a considerable proportion of it as before shewn will find its way into the river or into smaller streams communicating with it, but another portion will be collected in the tanks, which are dug for this purpose, and a third portion after percolating through the soil will find its way into numerous shallow wells. These tanks and shallow wells may therefore be considered as being merely pits for the accumulation of drainage from the immediately surrounding soil. In the case of Calcutta the town is densely populated, and as the manners and customs of the native inhabitants are in many respects very primitive, the soil must be inevitably charged with excretal and other refuse, so that the water when it reaches the tank or well, will be largely contaminated with the impurities derived from these sources. In the absence of any system of drainage, as was the case in Calcutta some years ago, such tank or well water could only

· Angus Smith on Air and Rain,

after use be thrown on the surface of the ground, or into the nearest ditch, from which it would either run or percolate into the tank or well a second time, and would naturally be in a still more impure condition. Such would appear to be the natural conclusions as to supplies of water derived from rivers, and from tanks and shallow wells in towns, and it will be subsequently seen that the quality of the Hooghly river water, and of the water of the tanks and wells within Calcutta, as deduced from numerous analyses fully bears out the above suggestions.

In speaking of the former supply of water to Calcutta, I have assumed that it was confined to the various tanks and wells distributed throughout the town; for though there is no doubt that the river water was used considerably by the inhabitants who lived near the banks of the river, yet the greater number of the inhabitants living as they did at a distance from the river, must have depended for their supply of household water on the tanks and wells nearest to them. The modern water supply of Calcutta which we have to consider is of course the Hooghly water collected at Pultah and, after filtration, etc., distributed through the ordinary mains.

For the purposes of this paper I have not thought it necessary to analyze all the tank and well waters in the town, which amount to many hundreds, but as I have examined 200 samples, some from the crowded districts of the northern part of the town, and some from the open maidan. I think a fair conclusion can be derived from them. I have also to mention, that a very large number of the well and tank waters which I have analyzed, have been noticeable for their bad quality, and for having apparently given rise to disease of one kind or another to the persons who were living in the neigh-Therefore the numbers usually obtained represent the bad bourhood. rather than the good waters of the old supply. I should however wish to point out, that there is every probability, that the water in the tanks and wells now, is of a much better quality then formerly it was, for by the present system of drainage and conservancy, a vast amount of excreta and filth of all kinds is removed from the town, which in former days must have remained to choke up the soil, and to render the tank and well water very much more impure than at present.

I will attempt first to shew, that, when the inhabitants of this town depended for their water supply on the tanks and wells, the quantity was decidedly insufficient during at least one half of the year.

With regard to the necessity of a sufficient supply of water being given to a town for domestic and sanitary purposes, a well known author on Hygiene, writes—*

"It was there shown that want of water leads to impurities of all kinds; the person and clothes are not washed, or are washed repeatedly in

^{*} Parkes' Hygiene, 5th edition, p. 37.

the same water; cooking water is used scantily, or more than once; habitations become dirty, streets are not cleaned, sewers become clogged; and in these various ways a want of water produces uncleanliness of the very air itself.

"The result of such a state of things is a general lowered state of health among the population; it has been thought also that some skin diseases—scabies, and the epiphytic affections especially—and ophthalmia in some cases, are thus propagated. It has also appeared to me that the remarkable cessation of spotted typhus among the civilized and cleanly nations, is in part owing, not merely to better ventilation, but to more frequent and thorough washing of clothes.

"The deficiency of water leading to insufficient cleansing of sewers has a great effect on the spread of typhoid fever and of choleraic diarrhoea; and cases have been known in which outbreaks of the latter disease have been arrested by a heavy fall of rain."

In judging of the quantity of water necessary to be supplied to a town, notice must be taken of the purposes for which the water is used. These we may roughly summarise by saying that water is required for drinking, cooking and the washing of persons, clothes, utensils and houses, for the flushing and cleansing of sewers and drains and for the watering of streets, for the drinking and washing of animals, the cleansing of carriages and stables, for trade purposes, etc.

From European statistics given by the authority just quoted, it would appear to be generally admitted, that a fair allowance of water for the purposes above enumerated is 25 gallons per head of population per day. Thus taking some of the largest towns in England and including Paris, each inhabitant receives 27½ gallons per day; the average daily supply of 14 English towns of second rate magnitude was 24 gallons per head, and that of 72 English and Scotch towns was found to be 26.7 gallons per inhabitant.

Let us now see the amount of water available in Calcutta during certain portions of the year when the old supply was depended upon. The tanks and wells in any town can of course only receive their supply of water from rain, and the rainfall of Calcutta is so unequally distributed, that almost three quarters of the whole fall takes place within 4 months of the year, whilst within 6 months, ten-elevenths of the rain falls. Thus the annual rainfall of Calcutta from 49 years' observation, has been found to be 65.85 inches, and during the months from November to April inclusive, only 6.03 inches fall on the average.

If we exclude from our calculation the months of heaviest rainfall, when the water would almost entirely run off into the river and be lost, and assuming for a moment that during these six months from November to April, the whole of the water which fell could be collected and

stored for use; then knowing that, according to the last Calcutta Census, the density of the population was 109 persons per acre, it is easy to calculate that each person could receive but 6.8 gallons of *fresh* water daily. In all probability, however, not one-fifth of the rainfall finds its way into these tanks and wells, and this would leave the inhabitants less than 1½ gallons of *fresh* water per day during the hot season of the year. In the Coomartolle Section of the town where the density of the population is 214 per acre, this supply must be reduced to one half or to about three quarters of a gallon of *fresh* water per day.

If even we were to assume, that it was possible to store up the water which fell during the rains, for use during the dry season of the year, and granting as before that one fifth found its way into the tanks and wells, even then each inhabitant of the town could not have had more than 6 or 7 gallons of fresh water daily, and an inhabitant of some parts of the northern division, could not have had more than 3 or 4 gallons.

The conclusion seems to me to be inevitable, that at the time when Calcutta depended for its water supply on its tanks and wells, the inhabitants must have used the same water over and over again though of course without knowing it, not only for such purposes as bathing, washing clothes etc., but probably also for cooking and even for drinking, and it would also appear that there could have been absolutely no water for necessary sanitary measures.

That Calcutta, under these circumstances, should have had a high rate of mortality is scarcely surprising.

I will now endeavour to show that the quality of the old water supply was even less satisfactory than its quantity, and that in a large number of instances of tank and well water, if not in the majority of cases, the water was, and still is, simply sewage, sometimes concentrated, sometimes dilute.

That impure water may be the source of disease is, I believe, now admitted on all hands, and if confirmation were required, abundant evidence to this effect is given in the various reports of the Rivers Pollution Commissioners in England. The researches too of Chauveau, Burdon, Sanderson, Klein and others scarcely leave room for doubt that the specific poisons of the so-called zymotic diseases consist of organized and living matter; and it is now certain that water is the medium through which some at least of these diseases are propagated. There does not appear indeed to be any doubt whatever that such diseases as cholera, typhoid fever, dysentery and diarrhœa may be produced by drinking impure or infected water. An excellent and most conclusive instance of the propagation of typhoid fever by water from one infected case near Basel in Switzerland is admirably described by Dr. Hägler, and is given in the sixth report of the Commissioners above referred to.

It is then evident that, in the analysis of water, the point to be aimed at would be, the detection of the presence of those impurities whether they be of the nature of germs or not, which would give rise to the diseases just mentioned, but unfortunately in the present state of science, we are quite unable even to say with any certainty whether such germs of disease will ever be isolated, and it is therefore clearly out of the power of the chemist to detect their presence in any sample of water. Failing therefore in this endeavour, the chemical analyst has to rest content with the detection and estimation of other substances, such as organic nitrogenous matter etc., which cannot be present in water, unless it has previously been in contact with the various forms of impurity, which we denominate sewage; and if such bodies are present in quantity, it is fair to infer that these germs or other bodies which produce the zymotic diseases, and which are undoubtedly present very frequently in sewage, may also be present in the sample of It has also been clearly shown, that in many instances water which is impregnated with animal or vegetable organic matter, even assuming any specific poison to be absent, will give rise to various unpleasant symptoms, such as diarrhœa, etc. It is therefore quite permissible and necessary to condemn any sample of water which is to be used as a potable or domestic supply, if it contains any quantity of organic matter, more especially if the organic matter be of animal origin.

The methods of water analysis have been improved very greatly during the past fifteen years, but even now there is a very warm discussion being carried on as to the respective merits of at least three distinct processes, and opinions differ materially as to which method gives most accurate and reliable results. The two methods for the determination of the amount of organic matter present in water, which have met with the greatest amount of support, are those of Professors Wanklyn and Frankland.

The method proposed by Prof. Wanklyn, which consists in the conversion of the nitrogenous organic matter into ammonia by boiling with an alkaline solution of potassium permanganate, has the immense advantage of being quickly performed with tolerably simple apparatus, and a whole water analysis by this method does not occupy more than a few hours. Against this method there is the well recognized fact, that it sometimes fails to detect and estimate the whole of the nitrogenous organic matter present in the water. It is therefore possible that a water may escape the condemnation which it deserves, but I believe it is generally accepted that a water which is condemned by this process must be really of very bad quality.

The method of analysis which was introduced by Dr. Frankland is an extremely elaborate one, and requires the use of very delicate and expensive apparatus. The greatest drawback to this process is however, the amount of work and time which is required for it, as a satisfactory analysis by it cannot be performed in less than 4 or 5 days. On the other hand the results obtained by Frankland's process are eminently trustworthy, and the character of a water is determined by it with great precision.

As I have been obliged to perform the work of analysis of the tank and well waters of Calcutta during the spare time from my current duties, and as some two hundred analyses had to be made by my own hands, it was clearly impossible for me to use Frankland's more accurate process, and I was compelled rather against my own notions of scientific accuracy to work with Wanklyn's process, which as I have pointed out is not so trustworthy as the other. In addition to this reason, I found that my predecessor in the office of Analyst to the Corporation had been in the habit of testing the Calcutta hydrant water by Wanklyn's process. As I had to carry on this method of analysis on behalf of the Corporation, this therefore formed a very intelligible standard of comparison for my work with the former water supply of Calcutta. In addition however to these analyses of the hydrant water, as will be seen subsequently, I have carried out for the last four years menthly analyses of the hydrant water by Frankland's process, and it is upon these numbers that I shall base my conclusions as to the character and quality of the present water supply.

In Wanklyn's process there are two principal determinations. The first is the estimation of the free ammonia present in the water, and of the albuminoid ammonia obtained by distillation with alkaline potassium permanganate. In India, I have frequently combined these two processes, and the ammonia from both is called the "Total Ammonia." The reason why these two processes have been combined is, that in almost every case when I have tested the potable waters of India for free ammonia, I have found it to be almost entirely absent. The fact appears to be, that at the very high temperature which here obtains, the ammonia oxidizes with such extreme rapidity, that if any free ammonia were present at the collection of the water, it would become partially or wholly converted into inorganic nitrogenous matters before the analysis could be performed, or, if the whole of the free ammonia were not thus oxidized, the changes which go on from day to day are so great, that for any true comparison in respect of this constituent between the samples of water analyzed, it would be necessary to analyze them at definite intervals after collection. The "total ammonia" then, which is spoken of subsequently, is the free ammonia present, if any, added to the ammonia produced from the nitrogenous organic matter by the oxidizing action of alkaline potassium permanganate. As pointed out before, it frequently happens that the whole of the nitrogenous organic matter present in the water is not decomposed, and therefore the numbers obtained always represent the minimum amount of impurity which can be present in the water.

Professor Wanklyn says with regard to this method of analysis, that by the aid of the ammonia process, we are now able to divide potable waters into three broad classes:

- (1) Waters which are of "extraordinary organic purity," i. s., those which are almost free from any nitrogenous organic matter, and which contain less than 0.05 parts of albuminoid (or total) ammonia per million of water.
- (2) "Safe waters," which are devoid of any excess of nitrogenous organic impurity, and which contain from 0.05 to 0.10 parts per million of albuminoid ammonia.
- (3) Waters which are "dirty," i. e. charged with an abnormal quantity of organic matter, and which contain more than 0.10 parts of albuminoid ammonia per million of water.

The second important consideration is the determination of the amount of chlorine present in the water. Chlorine occurs in potable water in combination with several metals (as chlorides), such as sodium, magnesium, calcium and possibly potassium. The amount of chlorides or of chlorine present in drinking water is in itself of little importance, for as most people are aware, common table salt is simply sodium chloride, and this substance is a necessary ingredient of our food. The water analyst determines the amount of chlorine present in water because the presence of this substance in water is in most instances a clear indication of contamination by sewage in some form or another.

It will be understood how this is the case when we consider that rain water, which is the source of all water supplies when collected in the open country and at inland stations is practically free from chlorine. Drinking water also which is uncontaminated by sewage is comparatively free from this substance, but sewage and urine,* are highly charged with chlorides, of which common salt is probably in largest quantity. If then a given sample of water contains no chlorine or very little, it cannot have been in contact with sewage, but if any considerable amount is present in a water, which is known not to have come from a tidal river or from any geological formation where deposits of salt are found, such a water would be viewed with the gravest suspicion, and if this were supported by other evidence, the water would at once be condemned. Unpolluted river and spring waters usually contain less than ten parts of chlorine per million of water, average town sewage in England about one hundred and ten parts; shallow well water may contain any quantity from a mere trace up to 500 parts or even more. The amount of chlorides is scarcely affected by any degree of filtration through soil; thus the effluent water from land irrigated with sewage contains the same proportion of chlorine

Human urine contains about 5000 parts of chlorine per million of liquid.

as the sewage, unless it has been diluted by subsoil water or concentrated by evaporation.

As an illustration of the quantities of total ammonia and of chlorine as chlorides found in samples of good or fairly good drinking water, I may quote some numbers taken partly from Prof. Wanklyn's work on water analysis, and partly from other sources such as the Rivers Pollution Commissioners' Reports. The numbers given in the following table show the number of parts of total ammonia and of chlorine in every million parts of the water, and the samples of water it will be seen are selected from a variety of sources, such as lakes, rivers, wells, springs, &c.

DESCRIPTION OF V	Total Ammonia parts per million of water.	Chlorine parts per million of water.		
London water, Kent Company,			0.03	23.≴
" " New River Comp		•••	0.08	15·7
Classes of the Table Comp	шу,	•••		
Glasgow water from Loch Katri	ne,	•••	0.08	7·6
Edinburgh town water,	•••	•••	0.07	14.3
Manchester town water	044	***	0.07	9.0
Chester (Dee) town water,	***	•••	0.07	5.0
Oxton (Birkenhead) town water,	***	•••	0.02	
Guildford water,	•••		0.01	12.6
Code-1	•••	•••		•
Caterham water from deep sprin	g,	•••	0.04	15· 5
Deep spring at Dorking,	•••		0.01	
Deep Well at Chatham,	•••	**	0.06	

As an additional comparison of the quantities of "Total Ammonia" and of Chlorine, which a good potable water should yield, I will quote the amounts of these substances which have been obtained during the last four years from analyses of the Calcutta Hydrant water made twice in each week. In the following table there are given the average results obtained for each of the last four years, as well as the general average for the whole of this period.

Calcutta Hydrant Water.

					<u></u>			
				No. of days of Analysis.	transmarant	No. of days when not perfectly filtered.		Chlorine in parts per million.
Average	e 1876.		•••	155	137	18	0.037	10.65
"	1877,	•••	•••	104	72	82	0.046	10.40
"	1878,	•••	•••	103	75	28	0.034	8.37
n	1879,	•••	•••	103	91	12	0.035	8.50
Æ	Sams,	•••	•••	465	375	90	0.152	37.92
	verage,	•••	•••	116	94	22	0.038	9.48

[•] When examined by transmitted light in a tube three feet in length.

In passing I may here remark, that a comparison of these numbers with those of the previous table, shows that the present water supply of Calcutta is really of excellent quality, and that very few of the good waters selected from those given in the works alluded to, are as pure as our hydrant water. That the purity of the hydrant water as determined by this process of analysis is not merely exceptional, is clear from the close agreement of the results of each year with the average of the four years. It will also be noticed that the hydrant water will fall in class one of Prof. Wanklyn's classification, as being a water of extraordinary organic purity.

On the other hand as examples of waters which are considered in England to be exceptionally bad, and which are at once condemned as sources of water for domestic purposes, and as examples of the results obtained from sewage, I may quote the following from Prof. Wanklyn's work on water analysis.

DESCRIPTION OF WATER.	Total ammonia parts per million of water.	Chlorine parts per million of water.	
Unfiltered Thames water at Hampton Court,	•••	0.32	11:4
Thames water at London Bridge,	•••	2.11	17·1
Well at Leek Workhouse (Staffordshire),	•••	0.36	7·1
Well in Windsor.	•••	1.28	80.0
Well in Eton,	•••	0.84	80.0
Pump in Drapers Hall, London.	•••	6.31	
", ", Bishopsgate St., London,	•	7.75	
", ", Bishopsgate St., London, ", ", Goodge St., London, ", ", Oxford Market,		l I	177.0
" " Oxford Market,	•••		474.3
Sample of Sewage,	•••	17:10	141-4

In addition to these examples I have analysed the Calcutta sewage by the same process. Thus on December 18th, 1877, samples of sewage were collected at each hour from 6 A. M. to 6 P. M. at the Pumping Station, and the amounts of total ammonia obtained from three of the samples showed 84.0, 87.0 and 145.6 parts per million of water. The average amount of chlorine was 170.4 parts in the same volume. This shows a much more concentrated sewage than that analysed by Prof. Wanklyn, but it is fair to state that the three samples of Calcutta sewage were of extreme concentration, and of a most repulsive and disgusting character.

If we take the first two tables above given as representing good drinking waters, and the last as representing sewage, either dilute or concentrated as the case may be, we are now in a position to understand the meaning of the numbers obtained by the analyses of two hundred samples of Calcutta tank and well waters, which are given in the tables below.

I have previously noticed the three standards of purity suggested by Prof. Wanklyn, but as in the case of these Calcutta tank and well waters, we shall be dealing with very impure samples, it will be well to adopt some standards of greater impurity than before given. I think it will be well within the mark to consider, that any sample of water which produces more than 10 parts of total ammonia should be classed as a sewage and not as a water, and that if the amount produced is between 10 and 5 parts, the sample may be called a dilute sewage; from 5 parts to 1 part we have a water considerably contaminated with sewage, and from 1 part down to Prof. Wanklyn's limit of 0.10 parts of total ammonia, we have the class of Dirty Waters, which represent water contaminated more or less with organic or sewage matter. In the same way we may adopt a classification of the amounts of chlorine present, and there is apparently no doubt that a Calcutta tank or well water which contains more than 250 parts of chlorine per million should be classed as a sewage; that a water containing from 250 to 150 parts of chlorine may be looked on as a dilute sewage; that with from 150 to 100 parts of chlorine present we have a water considerably contaminated with sewage; and when from 100 to 50 parts are present a water may be said to be slightly contaminated, whilst if less than 50 parts of chlorine are present, the water may be considered moderately safe.

The first of the two following tables contains the results obtained from the analysis of the tank waters, and the second the numbers obtained from the well waters. The tables contain 9 columns, most of which are explained by their headings. Column 1 gives the date on which the water was analysed, 2 and 3 the locality from which the sample was drawn and the section of the town in which the tank or well is situated. 4 gives the reason why my attention was called to the state of the tank or well, and which lead to the water being analysed. Column 5 gives a very brief description of the physical characters of the sample, principally as to colour, smell, presence or absence of solid matters in suspension, presence of animal life etc., and under this head it may be mentioned that as most of the waters were extremely dirty and thick, the examination as to colour was made in a glass cylinder only six inches high standing on a white surface. Columns 6 and 7 give the amounts of total ammonia and of chlorine present in every million parts of water. Column 8 gives the decision as to whether the water was considered fit for potable purposes or whether it was condemned for such uses, and the last column shews whether the tank or well has been subsequently filled up or dewatered.

Most of these results have been submitted to the Health Officer to the Municipality in my capacity of Water Analyst, and it is due to the courtesy of Dr. McLeod that I am able to give the columns 4, 8 and 9.

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A. Pedler—On the past and present														[No.					
What was done to the Tank.	K11 64 118	r mon ab.		Filled up.		Filled up.	Filling.	,	rmea up.	å	គំ			Filled up.		TX:114mm	9			
Whether condemn- ed for domestic purposes or not.	Con-	Do.	Ö,	ទំនំ	ខំព	ទំនំ	Ď.		G	Do.	ņ.	ć			ů.	É	Š	Ď.	D ₀	
Amt. of Chlorine parts per million.	18.52 582.00	26.20 639.00	24.80 568.00	18 00 550-25 10 00 390-50	2.40 443.75	2.00 614.75 2.00 614.76	2.20 255.60		00.012 00.03	13.75 319.50	9-60 268-25	0.00	4	36.50	1.62 184.60	110.00	00.881 00.	3.40 266.25	7.65 879.75	0.60 81.96
ainommA latoT anomilim req straq	18.52	26.20	24.80	10.00	9.40	00 00 00 00 00 00 00 00 00 00 00 00 00	8.20	0	00.03	13.75	9.60	0.0	1:30	89.0	1.62	ģ	3	8:40	7.65	0.00
Description.	For cholera death in neighbourhood. Yellowish green color, very turbid. Full of life.	Yellowish green color, very turbid. Full of life.		Green color, unpleasant smell, suspended matter. Brown white color. Very turbid, Full of life.	Tolerably clear. Full of life.	Greenish color, very turbid. Full of life. Rather clear; small floating worms.	Yellowish white color turbid contains animal life.	Yellowish green color, stinks horribly, full of sus-	pended matter and animal life. Green color, stinks horribly, full of sediment,	Whitish green solor rether strong affile full of	animal life.	Green color, stinks horribly, full of life, animal	Of greenish color, slightly turbid.	Yellowish color, slightly turbid.	Brownish color, contains suspended matter and considerable amount of animal life.	₹	II any animal life visible. Slight greenish color, faint smell, turbid, full of	animal life. Greenish white color very unpleasant small seem	turbid, full of animal life.	apparently not in large quantity.
Eeason why water was submitted to analysis.	For cholera death in neighbourhood.	Do.	Do. and complaint.	Filthy state. Do.	Do.	Do.	Cholera death in neighbourhood.	Filthy state.	Do.	É		Do.	Do.	Ď.	Do.	Cholera death in	neignbournood.	Do.		
Section.	٥	0		BA	m.	A A	0	O	M	Þ	4	Z	3	-	7	A	Z	Z		
Locality.	No. 19, Goa Bagan Street, North Tank.	No. 19, Goa Bagan Street, South Tank.		Nihareeparah. Nundoram Sen's Street.		Boloram Ghose's Street. Raja Rajbullub Street.		7, Grey Street.	Kerr's Lane.	141 Dhummetellah Straat	111, Dumirumonan Sures.	10. 102, Jaun Bazar Street.	Presidency Jail Tank.	Alipore Ja	Sookea's St. Thana, North Tank.	Sookes's St. Thana, South	Komadan Bagan, Double	Tank. Tank Haree Tollowa.	D Tank Water.	
Date.	March. 1		oT "	"; 22	28	" " 80 80 80	April 20.	May 2.	ස් :			, 10.	Aug. 15.		Sept. 19.	2	Dec. 16.	:	3	

Tank Waters, 1877.

What was done to the Tank.	De. watered.			No. 80, Filled up.	Filled up. Do. No. 33,	Filled up. Filled up.	Filled up.		
Whether condemn- ed for domestic purposes or not.	Con- demned. Do.	Do.	°Č	å	នំនំ	នំនំនំ	å	å	å
Amt. of Chlorine parts per million.	3.06 156.20 2.52 475.70	16.00 170.40	14.80 195.25 10 71.00 10 65.67 08 22.86	8.00 230.75	61.28 355.00 47.04 230.75	24.00 142.00 24.00 230.75 20.00 387.25	12.84 159.76	40.80 319.50	248.20
Total Ammonia parts per million.	8.06 2.52		.10 .10 .10 .08	8.00	61.28 47.04	24.00 142.00 24.00 230.75 120.00 387.25	12.84	40.80	16.00 248.50
Description,	Greenish white color, turbid, and full of animal life. Of a greenish color, turbid, and full of animal life.	Of a whitish color, turbid, and full of animal life.	Of a whitish color, and turbid, Of a whitish color, and turbid, Of a whitish color, and turbid, Of a whitish color, and turbid.	Green color, stinks horribly, turbid, full of green suspended matter.	Whitish brown color, smells badly, very turbid. Green color, suspended matter, stinks, turbid, full of animal life.	Green color, suspended matter, stinks, turbid. Brownish color, faint smell, slightly turbid. Greenish white color, faint odour, very turbid,	green suspended matter. Greenish white color, faint smell, turbid.	Brown almost black color, stinks, very turbid, full	r, stinks, excessively turbid.
Reason why water was submitted to analysis.	Filthy state. Cholera death in neighbourhood,	Filthy state.	Complaint of do. Filthy state, Do.	Cholers death in	Do. Do.	Do. Filthy state. Do.		Filthy state.	Do.
Section.	0 A	0	五克瓦克	×	ZZ	ZZZ	M	M	M
Locality.	Godai Khansama's Lane, Colinga. Gopal Mitter's Tank in Brindabun Mullick's	Dhankhit Tank, Colvin's	74, Dhurumtollah Street. Tolley's Nullah. Hastings Bridge, (foot of). Tolley's Nullah taken between High water and	31, Neogipuker East Lane.	42, Harespara Lane. 62, Lower Circular Boad.	32, Neogripuker East Lane. 80, Hareepara Lane. 16, Neogripuker W. Lane.	18. 19, Okur Dutt's Lane.	19. 18, Holodhur Buddan's	20. 15, Takoor Doss Paulit's L.
Date.	Jan. 9.	, 16.	Feb. 13. " 28. Mar. 6.	., 18.	" " 13.	17.	. 18.	, 19.	. 20.

Tank Waters, 1877—Continued.

What was done to the Tank.	Filled up.
Whether condenned for for domestic purposes or not.	demand, Do. Do. Do. Do. Do. Do. Do. Do. Do. Do.
Amt. of Chlorine parts per million.	24-00 266-25 16-00 159-76 16-00 189-76 16-00 284-00 16-16 408-26 240-00 1159-76 1-80 479-26 26-40 426-00 0-48 117-00 16-00 461-50 8-00 266-26 12-60 248-50 12-60 286-76 28-66 685-75 20-00 801-75 8-00 380-60
Total Ammonia parts per million.	24-00 16-00 16-00 16-00 16-00 1-80 1-80 1-80 1-80 1-80 1-80 1-80 1
Description.	For Cholera death Brownish or blackish white color, stinks, in neighbourhood. Do. Greenish white color, stinks, turbid. Brownish white color, stinks, turbid. Brownish white color, stinks, turbid. Do. Greenish brown, stinks horribly, excessively turbid. Brownish white color, slinks, excessively turbid. Thurbid. Brownish white color, slinks, excessively turbid. Brownish white color, slinks, turbid, iltile suspended matter. Brownish white color, slinks turbid, stinks horribly, excessively turbid, full of bright green suspended matter. Brownish brown color, stinks, very turbid. Cholera death. Whitish green color, stinks, very turbid. Whitish green color, stinks, opalescent, suspended matter. Do. Brownish color, smells, opalescent, suspended matter. Brownish color, stinks horribly, extremely opalescent, suspended matter. Brown color, stinks horribly, extremely opalescent, suspended matter. Brown color, stinks horribly, extremely opalescent, much suspended matter. Brown color, smells, opalescent, suspended matter.
Reason why water was submitted to analysis.	For Cholera death in neighbourhood. Do. Do. Do. Do. Do. Do. Do.
Section.	M MAAMM M MAM D O O O O O
Locality.	10, Okur Dutt's Lane. 15, Ooriahpara Lane. 16, Cornwallis Street. 22, Sunkur Ghose's Lane. 36, Sankaritollah Lane. 103 & 104, Serpemtine Lane. 2 & 3, Holodhur Buddan's Lane. 3, Ukur Dutt's Lane. 8, Ukur Dutt's Lane. 9, Sepentine Lane. 9, Sepentine Lane. 7, Grey Street. 115, Upper Chitpore Road. 7, Grey Street. 115, Upper Chitpore Road. 22, Musjeedbarree Street. 63, Hurry Ghose's Street. 63, Hurry Ghose's Street. 5, Fukeer Chand Chatter- 5, Taruk Chatterjee's 1, Taruk Chatterjee's 1, Durjouparah Street.
Date.	Mar. 20. "" 21. "" 22. "" 26. "" 26. "" 26. "" 29. "" 31.

1880.]				W	ater	sup	plie	of	Calc	utta	. .				99
	Nos. 19	filled up.			No. 74,	dewardred Filled up.		Filled up.		Filled up.		Filled up.			
Con- demned. Do.	Do.	Do.		Do.	Š.	Ğ B	å	Š.	Ď.	Ď.	Do.	Ď.	Do.	å	
6.40 426.00 Con- demne 20.96 837.25 Do.	8-90 177-60	7.20 124.25	74.50	81.60	2.36 159.75	2.68 142.00	2.64 276.90	4.29 71.00	8.95 142.00	4.40 213.00	2.59 266.25	9-00 801-75	8.40 185.25	12.00 185.25	
	8:30	7.50	Lost	3.20	3:36	89.7	2.64	4.29	8.95	4.40	2.59	00-6	8-40	12.00	
April 10. 28, Goa Bagan W. Goalla- C Complaint of rag. Greenish black color, stinks, opalescent, full of ing cholera. Bright green color, stinks, excessively opales. 16, Do. C Do. Do. C Do. Do.	cent, rul of suspended marker. Greenish white color, stinks, with much sus- rended matter and sujmel metter	Yellowish color, unpleasant smell, alightly	thread, suspended matter & also animal life. Almost colorless and smalls unpleasantly; Lost.	much suspended matter. Stinks of sulphuretted hydrogen, becomes opslescent on exposure, much suspended	matter. Yellow color, smells slightly, contains sus-	A	suspended matter, much animal life Water of a yellowish color, faint unpleasant	Smelt, much animal life. Yellowish color, stinks, opalescent, contains	Animal ine. Yellowish color, smells slightly, slightly opa-	•	Yellowish green color, stinks, some suspended	Greenier, control of the control of	<u> </u>	Enverigh white color, unpleasant smell, slightly oppleacent, small quantity suspended matter, full of animal life.	
Complaint of rag- ing cholera. Do.	Foul state.	Ď.	Ď.	Do.	Foul state.	Cholera death in	neighbourhood.	ő	Complaint	Cholera death in	Filthy state.	Complaint.	Cholera death in neighbourhood.	On Tank Committee's re- port.	·
0 0	0	z			0	124	×	0	0	н	٥	٥	A	H	
28, Goa Bagan W. Goalla- para. 16, Do. Do.	12. Double Tank, Komadar Bacan Joratolla	99, Jaun Bazar Street.	" 16. Tank A.	Tank B.	Aug. 7. 75 & 76, South Colinga St.	10. 24, Baranosee Ghose's St.,	Singhee Bagan. 29, Neogipukur East Lane.	10 & 12, Elliot's Road.	" 10. 6, Hill's Lane.	26. 62, Machooa Bazar Street.	27. 44, Musjeedbarry Street.	38, Nilmoney Mitter's St.	Nov. 2. 7, Sookea's St., Bye-Lane.	11, Carey's Church Lane.	
April 10.	, 13.	*	" 16.		Aug. 7.	, 10.	%	Oct. 9.	,, 10.	,, 28.	, 27.	. 30.	Nov. 2.		

Ink Waters, 1877—Concluded.

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Date.	Locality.	Section.	Reason why water was submitted to analysis.	Description.	sinommA latoT parts per million.	Amt. of Cholerine parts per million.	Whether condemn- ed for domestic purposes or not.	What was done to the Tank.
Nov. 8.	Colvin Bustee Tank.	3	Cholera death in	_	13.00	195.26	13.00 195.26 Con-	
t t	0 Shammker Street	4	neighbourhood.		0.94	0.84 181 05	demned.	
<u>.</u>		1	Š	cent, full of green suspended matter and animal life.	5	3	<u> </u>	
. " 11.	11. 86, Machooa Bazar Street.	A	ឧំ	Yellowish brown color, slight smell, opalescent, full animal life.	11.30	11.30 159.75	å	
,, 12.	12. 6, Emambang 2nd Lane.	5	Complaint.	Green color, faint smell, much suspended	8	8.00 113.60	ů.	
, 13.	18. 76, Jam Basar Street.	z	Cholera in	Greenish yellow color, stinks, rather opalescent,	2.76	2.76 202.35	ñ	
			neighbourhood.	small quantity of suspended matter, full of animal life.				
Dec. 10.	Dec. 10. 46, Kally Prosad Dutt's St.	ರ	ខ្មុំ	Dark green brown color, on being kept a few	28.66	28.26 205.90	Ď.	No. 64,
;			É	matter, and animal life.				r med ab.
:	3, 11. 104, Opper Circuiar Rosa.	<u>.</u>	ร์	whilsh brown color, when kept a lew days has a very bad smell, full of green suspend-	79.87	02.797 70.87	°	
	19 Name Namellak's	_	\$0 pt 100	ed matter, contains animal life.	9			
2	Lane.	_		moderate amount of suspended matter,	•	00-191 04-0	ŝ	
			_	much animal life.				
, 18.	18, Hareepara Lane, and 16, Neogipuker West	Z	Filthy state.	Green color, stinks most horribly, much suspended matter, full of animal life.	11:16	11:16 244:95	°C	Filled up.
					_		_	

1878.
Waters,
lank

					ŀ				o
Date.	Locality.	Section.	Reason why water was submitted to analysis.	Description.	sinommA latoT noillim 19q straq	Chlorine parts per million.	Whether condemn ed for domestic purposes or not.	What was done to the Tank.	ر٠,
Jan. 2.	64, Raja Rajbullub Street.	┫	Cholera death in	Deep yellowish color, very unpleasant smell,	21.30 475.70		Con-		,
. 7.	3, Fukeer Chand Mitter's	Q	neignbournoor. Do.	Vellowish green color, unpleasant smell, little	3 ·46	92.30	Ď.		,,
œ : \$	Lane. 129, Cornwallis Street.	0	Do.	Suspended marcer, concurs anima inc. Bright green color, sinks, much suspended	21.06 280.45	280.45	ů.	No. 30,	
	4, Fukeer Chand Mitter's	D	Do.	marter, much some suspended matter.	12.00 149.10	149-10	å	-da nom -	wpp:
10.	Lane. 21, Do. Do. Do.	Ω	Do.	Yellowish green color, unpleasant smell, slightly opalescent, little supended matter,	4.70	4.70 127.80	Ď.		•00 0
, 19.	81, Shampookur Street.	₽	ϰ.	animal life. Yellow color, slight smell, little suspended	2.72	2.72 142.00	å		ou.
30.	27, Noyau Chunder Dutt's	Ö	Do.	Wellow, stinks, small interpretation of market no visible suitability.	1.47	1.47 124.25	Ğ		
£	Lane. Karbala tank water.	ဝ	Do.	Has a brown color, unpleasant smell, contains	1.49	1.49 276.90	Õ		•
Feb. 27.	162, Bow Bazar.	н	Do.	Yellow brown partor no life.	40.66 266.25	266.25	Do.		
*	1, Nemoo Gosain's Lane.	Д	Do.	Brown color, stinks badly of sulphuretted hydrogen, opalescent, much suspended mat-	23.50	23.20 479.25	Do.		
Mar. 5.	Jinghu Bagan.	-	Do.	ter, animal life. Green yellow color, stinks horribly of sulphuretted hydrogen, opalescent, much suspend-	11.50 408.25	408.25	O		
.	2, Manicktollah Street.	٦	Do.	ed matter. Brownish color, stinks, very opalescent, much suspended matter, animal life.	88.74 461.50	461.50	Do.		101

Tank Waters, 1878-Continued.

What was done is the tank.										
Whether condemn- ed for domestic purposes or not.	Do.	ů.	å	Š	å	Ď.	Ď.			Ď.
Chlorine parts per million.	8.62 248.60	17-00 819-60	7.68 301.76	8.02 230.75	42.66 855.00	1.31 102.96	2.16 220.10	0.80 24.80	0.84 147.68	0.17 2878·5
rotal Ammonia parts per million.	<u> </u>		2.68	8.02	99.7	1:31		8.0		0.17
r. Description.	Cholers death in Greenish color, stinks, very opelescent,	<u> </u>	Brownish color, bad smell, very opalescent,	Yellowish white color, stinks, large quantity	<u>~</u>	Green annual 110e. Greenish color, faint smell, small quantity	Greenish color, stinks, green suspended matter in large quantity, animal matter in	quantity.	Yellow color, slight smell, small quantity	suspended marker. Yellowish brown, slight smell of sulphuretted hydrogen, much suspended matter.
Reason why water was submitted to analysis.	Cholers death in	Do.	Do.	Complaint.	Cholera death in	neignbournood. Do.	Do.			
Section.	٦	P	4	∢	-	H	А	Ħ	Ħ	ద
Locality.	222, Cornwallis Street.	26, Prossunno Coomar Tagore's Street.	22, Horo Lall Mitter's	45, Shampookur Lane.	54, Old Boytuckhanah	Mirzapore Public Tank.	Badoorbagan Tank, 83, Upper Circular Road.	April 27. Dhurumtollah Public Tank.	May 10. Wellesley Street.	Palmer's Bridge.
Date.	Mar. 11.		, 12.	, 13.	2	, 26.	2	April 27.	May 10.	"

Tank Waters, 1879.

			1	Taura Marcial tolor				
Date.	Locality.	Section.	Reason why water was submitted to analysis.	Description.	ainommA latoT parts per million of water.	Chlorine parts per million of water.	Whether condemn- ed for domestic purposes or not.	What was done tank.
Jan. 23. June 20. July 4. " 5. " 7. Oct. 10. " 11.	Jan. 22. 82, Upper Circular Road. June 20. Rawdon Street. July 4, 36, Goorooprosad Chaudry's Lane. 22, Durga Churn Muker-Jea's Street. 7. 4, Brindabun Mullick's Lane. Oct. 10. 5, Peary Mohun Paul's Lane. 11. 10 and 11, Jorapukor Lane. 14. 160, Gokul Mitter's Lane. Baug Bazar.	N M G H A A A A A A A A A A A A A A A A A A	Cholera death in neighbourhood. Do. Do. Do. Complaint. Cholera. Complaint.	Blackish green color, very bad smell, suspended matter, contains animal life. Yellow color, stinks badly, much suspended matter, contains animal life. Yellowish color, slight odour, small quantity of suspended matter, animal life in small quantity. Blackish color, stinks abominably, much suspended matter. Brownish color, stinks badly, much suspended matter. Brownish color, bad smell, opalescant, small quantity of suspended matter. Brownish black color, unpleasant smell, very opalescent, large quantity of suspended matter. Blackish brown color, stinks badly, very opalescent, large quantity of suspended matter. Brown color, stinks abominably, very opalescent, large quantity of suspended matter. Brown color, stinks abominably, very opalescent, large quantity of suspended matter.	2.68 9.00 4.20 1.98 8.72 7.20 92.40 92.40	2.68 248.50 9.00 213.00 4.20 269.90 1.98 209.45 8.72 213.00 7.20 223.65 92.40 177.50 77.60 177.50 11.52 248.60	Condemned. Do. Do. Do. Do.	
				1880.	-			
Jan. 24.	Jan. 24. No. 19, Goa Bagan Street.	٥	Cholera.	Grey color, slight odour, much suspended matter, much animal life.	13.86	13.86 819.50	ϰ.	Filled up.

Tank Waters, 1880—Continued.

What was done to the tank.												
Whether condemn- ed for domestic purposes or not.	Con-	Do.	Š.	ů A	Do.	Do.						
Chlorine parts per million of water.	15·20 196·25	4.00 159.75	6.00 142.00	23.20 337.25	6.30 355.00	8.00 401.15	0.16 255.60	18.84	8·16	82.66	16.68	24.14
Total Ammonia parts per millim respectively.	1	4.00	9	23.20	6.30	8:00	0.16	60.0	0.10	0.10	20.0	0-11
Description,	5	3	Green color, stinks abominably, much sus-	Bright yellow color, unpleasant smell, sus-	Green color, unpleasant smell, suspended	Green color, strinks bally, very turbid, sus-	Slight yellow color, no smell, almost clear and	Greyish color, no smell, rather turbid, small	Slight, greyish color, no smell, rather turbid,	Grey color, no smell, rather turbid, small	quantity of animal life. Almost colorless, no smell, almost clear and transparent, very small quantity of animal	Life. Almost colorless, no smell, almost transparent, small quantity of animal life.
Reason why water was submitted to analysis.	Prevalence of	Swelling tever. Do.	Do.	Complaint.	ϰ.	Do.						
Section.	0	0	0	<u>F</u> +	ຽ	А				ляБі	Mai	
Locality.			28. 35, Elliott's Road. O	29. 11, Mohendra Gossain's F		May 29. 81, Bachoo Chatterjea's D	South of Park Street old	Birju Tank, south of	ik, north of	k opposite	Monohar Dass's Tank P	10. Tank opposite Esplanade.

Well Waters, 1877.

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What was done to the well.													
Whether condemn- ed for domestic purposes or not.	Con-	Do.	Do.	Ď.	ů.	Ď.	Ď.	Ď.		Do.	Do.	ϰ.	Do.
Amt. of Chlorine parts per million.	1.68 177.50	0.80 248.50	213.00	514.75	0.62 621.25	0.50 248.50	1.76 142.00	0.90 456.00	39.20	0.40 177.50	307-70	390-50	3.68 791.65
ainommA latoT noillim req atraq	1.68	08.0	0.40	8.20	0.62	0.20	1.76	06-0	0.20	0.40	4.15	2.40	3.68
Description.	ਠ	Slight brownish color, no smell, little sus-	pended matter. Almost colorless, no suspended matter.	Yellowish color, no smell, traces of suspended	Almost colorless, faint smell, small amount of	Brownish color, faint smell, small amount of	Brownish color, nasty smell, opalescent, sus-	Slight yellowish color, faint smell, small	Almost colorless, faint smell, small amount of	Brownish color, faint smell, suspended matter. Yellowish color, faint smell, much suspended	matter. Strong yellowish brown color, faint smell,	much suspended matter. Yellowish color, faint unpleasant smell, little	suspended marker. Almost colorless, faint unpleasant smell, suspended matter.
Reason why water was submitted to analysis.	Cholera death in	Filthy state.	Do.		Filthy state.	Ď.	Do.	Do.	Do.	Do.	Filthy state.		Filthy state.
Section.	田	国	Ð	×	闰	闰	闰	闰	Ħ	ರ ರ	国	闰	ರ
Locality.	8. 5, Jorabagan.	9. 1, Horo Lall Doss's Lane.	10. 16, Burrabazar Moyda-	putty. 11. Jaunbazar Bustee.	24, Jorabagan Street.	6, Jorabagan Street.	14. 7, Horo Lall Doss's Bustee.	9, Shama Bye's Gully.	30, Burtollah Street.	9, Burrabazar Baneaputty. 145, " Hookaputty.	3, Hanspookur Gully.	19. 159, Machoos Bazar Street.	Aug. 10. 146, Burra Bazar.
Date.	May 8.	.6	" 10.	" 11.	13.	, 13.	, 14.	, 15.	" 16.	" 17.	. 18.	, 19.	Aug. 10.

Well Waters, 1877—Continued.

Date.	Locality.	Section.	Reason why water was submitted to analysis.	Description.	ainommA latoT noillim req arraq	Amt. of Chlorine parts per million.	Whether condemn- ed for domestic purposes or not.	What was done to the well.
Aug. 10.	Aug. 10. 24, Jorabagan Street.	闰	Cholera death in	Yellowish green color, faint unpleasant smell,	2.84	2.84 265.25	Con	
, 11.	3, Hanspookur Lane.	田	neighbourhood.	suspended matter, animal life distinct. Almost colorless, faint smell, small quantity	1.42	1.42 390.50	demned. Do.	
, 12,	6, Jorabagan Street.	Ħ	Cholera death.	suspended matter. Yellowish color, faint unpleasant smell, small quantity suspended matter, distinct animal	8.76	8.76 159.75	Ď.	
, 13.	30, Burtolah Street.	呂		life. Colorless, faint unpleasant smell, largequantity	2.73	2.73 819.60	ů.	
, 14.	9, Shama Bay's Lane.	띄		Of suspended matter, distinct animal info. Almost colorless, faint unpleasant smell,	2.64	2.64 408.50	å	
, 15.	24, Bustee Joraban Street.	떰		small quantity suspended matter. Brown color, stinks badly, very opalescent,	17.40	17-40 159-75	ů	
,, 16.	16. 1, Horo Lall Doss's Lane.	된		much suspended marter, distanct animal life. Almost colorless, faint smell, small quantity	8.92	8.95 177.50	ů.	
" 17.	17. 16, Burra Bazar Moyda-	ಶ		of suspended matter. Colorless, faint unpleasant smell, little	2.83	2.83 177.50	å	
, 18.	bury. 6, Jorabagan Street.	厨.	Cholera death.	Whitsh yellow color, smells unpleasantly, opplescent, suspended matter, and traces of	16.80	88-76	ϰ	
,, 19.	19. 9, Burrabazar Baneaputty.	ರ		animal life. Almost colorless, faint unpleasant smell,	8.58	8-28 196-26	å	
. 20.	Ā	B		suspended matter, animal me. Yellow color, decided unpleasant smell, sus-	4.82	4.82 248.50	å	
,, 22.	Lane. 186, Serpentine Lane.	×		pended matter. Yellow color, unpleasant smell, little suspended matter, much animal life.	9.40	6.40 621.25	å	
-		_				-	-	

Well Waters, 1878.

o. j	ry at	er si	sppne	8 0J	Out	cutta.					107
What was done to the well.											Filled up.
Whether condemn- ed for domestic purposes or not.	Con-	Do.	ϰ.	Do.	Do.	Do.	ů	Do.	ů.	ů.	Ď.
Chlorine parts per million.	88.76	51.50 841.85	3.30 639.00	8.80 479.25	1.92 152.65	12.80 582.20	0.80 452.60	0.60 450-85	48.00 816.50	0.94 608.50	17-52 514-75
Richard Ammonia.	1.40	61.50	3 .30	8:30	1.92	12.80	08.0	09.0	98.00	0.94	17.62
Description.	A	Almost black, unpleasant smell, excessively	Slight brownish tinge, slight smell, small quantity, suspended matter, no visible	Yellow colors, slight smell, some suspended	Yellow color, unpleasant smell, small quan-	Yellowish color, unpleasant smell, moderate anount suspended matter, no visible animal life.	Almost colorless, slight smell, small quantity	Almost colorless, no smell, very small quan-	Yellow tupleasant smell, much suspend-	Almost colorless, slight smell, small quantity	Yellow color, unpleasant smell, much suspended matter, no visible animal life.
Reason why water was submitted to analysis.	Cholers death in neighbourhood.	Do.	Do.	Do.	Do.	°G	ů.	Ď.	Ď.	Do.	Do.
Section.	Ö	Д	m	×	0	⋖		M	M	×	æ
Locality.	Jan. 28. Doorga Churn Mittur's Street.	" 30. 13-A, Nattur Bagan.	7. 13-B, Nattur Bagan.	14, Smith's Lane.	30, Noyau Chaund Dutt's	10, Ram Kanto Bose's Lane.	Railway Tank, Sealdah.	20. 128-J, Bow Bazar Street.	20, Bamutollah Street.	25. 34, Serang's Lane.	28. 1.D, Nemoo Gawaat's Lane.
Date.	Jan. 28.	. 30.	Feb. 7.	2	*	" 16.	. 19.	, 20.	, 23.	" 25.	, 28.

Well Waters, 1878—Continued.

What was done to the well.												
Whether condemn- ed for domestic purposes or not.		demned. Do.	Ď.	Do.	Do.		Ď.	Do.	۳- گ	Ď.	Do.	Do.
Chlorine parts per million.	0.94 603.50	41.06 532.50	6-96 390-50	8.36 319.50	11-17 492.00	0.50 195.25	63.25	781.00	18.60 319.50	14.80 514.75	2.00 284.00	9.48 280.75
ninommA fatoT noillim req straq	0.94	41.06	96-9	8 :36	11-17	0.50	2.50	222.00 781.00			8.00	9.48
r Description.		of suspended matter, no visible animal life. Brownish color, unpleasant smell, slightly ops-	Brownish color, stinks, suspended matter, and	ruch animal life. Yellow color, slight smell, small quantity	Black color, horrible stench of sulphuretted hydrogen, very opalescent, much suspended	matter. Slight yellowish tinge, slight smell, little	suspended matter. No smell, small quantity suspended matter,	no visiole animal life. Full yellow color, slight smell, much suspended matter, distinct animal life visible under	microscope. Almost colorless, very slight smell, little suspended matter, distinct animal life under	Almost colorless, very slight smell, much	Slight yellowish color, very slight smell,	little suspended matter, no animal life. Yellowish color, no smell, little suspended matter.
Reason why water was submitted to analysis.	Cholera death in	neighbourhood. Do.	ϰ.	ϰ.	Do.	Do.	Do.	Do.	Ď.	Do.	Do.	Do.
Section.	Ι	ф	В	В	В	闰	떰	料	Д	臼	Œ	н
Locality.	Feb. 28. 13-J, Patwai Bagan.	21, Nathu Bagan.	1, Nemoo Gosain's Lane.	Mar. 4. 71, Dhurumtollah Street.	9, Boloram Mozoomdar's Street.	7. 168, Cotton Street.	113, Dhurumtollah Street.	82-5, Burtollah Street.	8. 27, Bonomally Sircar's Street.	23-9, Durponaryan's Lane.	17-22, Durponaryan's	Tagor's Street. 3, Antony Bagan Lane.
Date,	Feb. 28.	*	*	Mar. 4.	£	" 7.	2		s;	. 6.		. 6

Con-	Do.	Do.	Do.	Do.	Do.	Do.	Do.	Do.	Do.		Do.	Do.	Do.	Do.
21.00	1384.5	727-75	6.24 218.00	9-96 319-50	68.00 550.25	8.52 426.00	0.46 126025	3 31 727-75	6.68 177.50	0.60 35.50	5.04 337.25	5.04 319.50	22.40 1029.5	3.62 532.50
1.92	219-00	35.74	5.24	96-6	00.89	8.52	0.46	3 31	89.9	09.0	2 ·0·4	5.04	22.40	3.62
Mar. 6, 26, Baranosee Ghose's F Cholera denth in Greyish white color, stinks badly, very 1.92 71.00 Con-	Deep brown color, unpleasant smell, opales- 219.00 1384.5 Do.	Yellow color, stinks badly, little suspended 35.74 727.75	Almaton, no amina ine. Almaton transparent and colorless, no	Colories, sight smell little suspended matter,	Blackish color, stinks badly, very opalescent,	Almost colorless, very slight smell, little sus-	Pended matter, no animal life. Almost colorless, slight smell, small quantity	Suspended marker. Yellowish color, nasty smell, little suspended	Yellowish color, very unpleasant smell, little	Almost colorless and transparent, very little	Greenish yellow color, unpleasant smell, much	When the color, slightly opalescent, little sus-	Yellowish green color, slight smell, much sus-	Almost colorless, no smell, little suspended matter, no visible animal life.
Cholera denth	Do.	D9.	ភ្នំ	Ď.	Do.	Do.	Ã	ϰ.	Do.	Do.	Do.	Do.	Do.	Q
Ē	Ħ	A	В	14	M	Ö	田	Ġ	Ē	н	M	٥	Ē	H
26, Baranosee Ghose's	6. 7-a, Bysack's Lane.	124, Manicktollah Street.	8. 21, Machoo Pal's Street.	" 11. 6, Ashutosh Dey's Lane.	5, Suri's Lane.	12, Nilmony Mitter's	" 12. 82-17, Burtollah Street.	14-C, Goomgur Lane.	222, Cornwallis Street.	1, Ram Chunder Banerjee's	" 13. 22, Free School Street.	15, Nilmony Mitter's	135, Machooa Bazar Street.	64, Old Boytuckhana I Bazar Street.
Mar. 6,	., 6.	*	œ £	" 11.			,, 12.	*	*	2	" 13.	*		

Well Waters, 1878-Conoluded.

<u> </u>		July 12. 27, Zig Zag Lane. " 16. 48-2-2, Bulloram Dey's Str. Sep. 23. Gangaram Barick's Well, 4, Bysack Bagan Lane.
		F1 F1
		F4
2 H	For improving Gowala Bustee.	24. Jogendra Nath Matee, 4, F For impr Bysack Bagan Lane.
		C Choler
		O Compl
	Cholera in	I Chole
		, 19. 840, Upper Chitpore Road. B Los Do
		E DOH B

Well Waters, 1879.

enob saw tadW Mean of to the same of the s					
Whether condemn- ed for domestic purposes or not.	Con-	Do.		Do.	
Chlorine parts per million of water.	0.33 639.00 Con-	12.60 372.75 7.92 301.75	<u> </u>	64.00 614.75	
sinommA latoT noillim req straq					
Description.	On the receipt of Almost colorless, no smell, small quantity objection from suspended matter, animal life.	Yellow color, no smell, opalescent, contains suspended matter. Bright yellow color, unpleasant smell, small quantity suspended matter, no animal life.	1880.	Black color, stinks abominably, large quantity of suspended matter, animal life.	
Reason why water was submitted to analysis.	On the receipt of objection from the owner to	dewater. Do.	_	Complaint.	
Section.	Ħ	н я		Α	
Locality.	Jan. 10. 14-2-89, Machooa Bazar Street.	", 16. 69, Sitanarain Ghosh's Street. June 17. 29, E. Gopee Kristo Paul's Lane.	_	Jan. 23. 6, Brindabun Mullik's Lane.	
Date.	Jan. 10.	" 16. June 17.		Jan. 23.	

Taking the results obtained by the Total Ammonia Test, and judged by the standards which have been put forward by Prof. Wanklyn, and the additional somewhat rough ones suggested by myself, it will be seen, as might be expected, that no single tank or well water was of extraordinary organic purity, and that there were only seven tank waters included under the head of "safe" waters, five of which were from tanks on the maidan. Of dirty waters there were 26 out of the 200 or 13 per cent.; of waters considerably contaminated with sewage matter 64 were found, or 32 per cent; of dilute sewages there were 32, or 16 per cent.; and of real genuine sewages 71 were found or $35\frac{1}{2}$ per cent., that is rather more than one third of the whole number.

In the following table these results are separated into the two classes of tank and well waters, and it will be seen that the impurity of both descriptions of waters is nearly equal when judged by this test.

	Sewages more than 10 parts of total ammonia.	Dilute Sewages from 10 to 5 parts of total ammonia.	Waters contaminated with considerable quantities of sewage, from 5-1 parts of total ammonia.	Dirty waters from 1 to 0.1 parts of total ammonia.	Safe waters from 0.1 to 0.05 parts of total ammonia.	Very pure waters less than 0.05 parts of total ammonia.	Total
Tank waters, Percentage,	52 42	19 15	36 30	10 7	7 6	0	124 100
Well waters, Percentage,	19 25	13 17	28 37	16 21	0	0	76 100
Percentage of both well and tank water,	35½	16	32	13	31/2	0	100

In considering the quantities of chlorine present, notice must be taken of the fact that in a well water the amount of chlorine will be relatively greater than that of the total ammonia derived from the organic matter, because in the filtration of the water through the soil to reach the well, all the insoluble portions of the organic matter present in the sewage, etc., will be stopped, whilst the chlorides will readily pass through in solution. Again in the filtration of contaminated water through layers of earth or soil, a certain proportion of the organic matter will be oxidized and converted into inorganic compounds such as nitrates, which will not yield any ammonia on distillation with alkaline potassium permanganate. Thus we may expect, that a larger proportion of the well waters will be condemned by the chlorine process than would be condemned by the total ammonia test.

The following table will show the classification of the tank and well waters according to the amounts of chlorine.

	Sewages containing more than 250 parts of chlorine per million.	Dilute sewages containing from 250 to 150 parts of chlorine per million.	Waters contaminated with considerable quantities of sewage containing from 150 to 100 parts of chlorine per million.	Dirty waters containing from 100 to 50 parts of chlorine per million.	Moderately safe waters containing from 50 to 20 parts of chlo.per million.	Good waters less than 20 parts of chlorine per mil- lion.	Total.
Tank waters,	56	38	14	6	7	3	124
Percentage,	45	30	11	5	6	3	100
Well waters,	49	18	1	5	2	1	76
Percentage,	64	24	1	7	3	1	100
Percentage of well and tank				J.		111	
waters,	$52\frac{1}{2}$	28	71/2	51	41	2	100

It would of course be quite permissible to consider waters which have been condemned by *either* of these two methods to be sewages, dilute sewages or unfit for domestic use, etc., but on inspection of the tables it will be seen, that as a general rule a water which is condemned by the total ammonia test is also condemned by the amount of chlorine present.

The results, however, are sufficiently startling, if we only take the mean of the results of the two determinations; and at the very lowest estimate it must be said, that of the 200 samples of Calcutta tank and well waters examined by me, forty-four per cent. were true sewages, twenty-two per cent. were dilute sewages, twenty per cent. of the waters were contaminated with considerable quantities of sewage, nine per cent. were "dirty waters," and about four or five per cent. only were moderately safe waters. These last consisted principally of the well kept tanks on the maidan, and two or three others in the southern part of the town.

In the next table I have grouped the well and tank waters according to the sections of the town to which they belong; in this table I have given, first the name of each section and its population per acre according to the census of 1876, then the total number of waters analysed from each section, with their classification according to the plan before adopted. There is also given the average composition of all the waters analysed in each section. It will be strikingly seen from this table, how much more impure the tanks and wells of the northern divisions are, than those of the southern sections of the town.

4		us of 1876.			.88.	ining consi-		s waters.		COMP	ERAGE OSITION OF VATERS.
NAME OF SECTION.	Sectional letter.	Population per acre by Census of 1876.	No. of waters analysed.	No. classed as Sewages.	No. classed as Dilute Sewages.	No. classed as waters containing derable quantities of sewage.	No. classed as Dirty waters.	No. classed as Moderately Safe waters.	No. classed as Good waters.	Total ammonia parts per million.	Chlorine parts per million.
A. Tank Waters. Shampooker,	ABCDEFGHIJKLMNOPQR	75 163 84 87 152 137 108 214 141 156 119 27 135 124 72 23 30 86 	10 4 21 14 16 2 1 13 0 3 14 10 0 3 5	4 3 15 5 1 4 1 1 2 11 0 1 7 1 0 0 0	1 1 1 2 2 2 0 1 0 0 0 3 2 0 0 1 0 0 0	5 0 4 6 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	0 0 0 1 0 0 0 0 0 0 0 0 0 0 0 0 0 1 0 0 0 0 0 0 0 0 0	000000000000000000000000000000000000000	000000000000000000000000000000000000000	8-86 12-60 14-62 6-48 17-00 26-21 92-40 8-20 21-93 51-77 4-96 23-70 5-13 7-17 0-09 0-09	339-0 377-2 367-7 215-3 319-5 295-8 191-6 177-5 199-1 209-5 307-2 164-0 241-9 164-0 162-1 53-0 19-1
B. Well Waters. Shampooker, Koomartooly, Burtolla, Sookea's Street, Jorabagan, Jorasanko, Burra Bazar, Colootollah, Moocheeparra, Bow Bazar, Puddapooker, Fenwick Bazar, Taltollah,	A B C D E F G H I J K M N	75 163 84 87 152 137 108 214 141 156 119 135	1 12 5 2 25 7 6 1 7 2 4	1 8 1 2 5 5 0 0 2 0 2 1 0	0 8 1 0 2 1 0 2 1 0	0 1 3 0 16 1 3 1 2 0 2	0 0 0 0 2 0 2 0 0 1 0 0	0 0 0 0 0 0 0 0 0	000000000000000000000000000000000000000	3·99 49·87 21·17 19.87	371-7 535-0 410-8 639-0 299-4 406-5 518-7

In classifying these waters I have not separately considered the two numbers I obtained by analysis for the total ammonia and chlorine, but have decided on the character of each water from the amounts of both these substances, and this table would therefore show the exact character which I have attached to the waters which I have analysed.

I scarcely think that it is necessary to criticise in detail the numbers which I have obtained in these analyses. In some instances the results of analyses showed that the tank and well waters are considerably more impure than the very concentrated Calcutta sewage, which was collected at the Pumping Station on December 18th, 1876. I have indeed never read in any work or research of such horribly filthy waters as these are, and they are waters which are now, or have been formerly used for domestic purposes by many of the poorer inhabitants of Calcutta.

Taking the numbers given in the foregoing tables, it may be said as a general result of the whole of these analyses, that an average Calcutta tank or well water contains 16:2 parts of total ammonia and 320:6 parts of chlorine per million of water. This it will be remembered from one of the previous tables, is if anything rather more impure than ordinary English sewage as obtained and analysed by Prof. Wanklyn. In the table referred to Prof. Wanklyn found in a sample of sewage 17:10 parts of Total Ammonia and 141:4 parts of Chlorine. We may also say that the average Calcutta tank or well water contains more than 400 times as much organic nitrogenous matter as is usually present in the hydrant water.

I have, however, no wish to enlarge to any extent on this decidedly nauseous topic, but perhaps the most striking condemnation of the well and tank waters of Calcutta, and which will appeal to every inhabitant, whether scientific or otherwise, is to say, that a good average quality of Calcutta tank or shallow well water may be made, by mixing six parts of our present hydrant water with from one to two parts of the most concentrated Calcutta sewage. This artificial tank or well water will be of about the average composition; it will also be so far as can be judged, equally healthy for potable and domestic purposes, and as for its taste, odour, etc., it will probably be rather superior to the general run of Calcutta tank and well waters.

So far as I can ascertain this was the kind of water which was commonly used for drinking and domestic purposes in Calcutta in former days, and which may to a certain extent be still used by the poorer inhabitants of the northern quarter of the town.

The present water supply, i. e., the Hydrant water.

I need scarcely mention that our present hydrant water consists of the Hooghly water pumped from the river at Pultah; it is there collected in

settling tanks, and after subsidence it is filtered through sand and then supplied to Calcutta. As I have made some remarks as to the quantity of the former water supply of Calcutta, this paper would not be complete if I did not refer to the quantity of our present supply. From the Report of the Municipality for the year 1879, I find that as the average for the whole year. 7,464,159 gallons of filtered water were daily supplied to the town. According to Mr. Beverley's Census of 1876, the number of inhabitants was 429,535, and each inhabitant would therefore receive 17.4 gallons of filtered water daily. But in addition to the filtered water, there is an unfiltered supply pumped up at Chandpal Ghat which is widely distributed through the town, where it is I believe used for such purposes as watering the roads and streets, flushing latrines and sewers, filling reserved tanks, etc. unfiltered supply was on the average of the whole year, 1,091,866 gallons, and therefore the total daily supply in Calcutta for the past year was 8.556.025 gallons, equivalent to 19.92 gallons per head, or practically there were 20 gallons of water available for domestic and sanitary purposes for each inhabitant. This though perhaps not an abundant supply is a fairly liberal one, and is very much larger than the quantity of the old supply from tanks and wells. It is, however, not equal to the quantity allowed in most European towns, for as pointed out in a former part of this paper the average daily water supply of English towns is at least 25 gallons per head of popula-In this country, however, it would appear that a more liberal supply would be required than in a European climate, and it has therefore been proposed to double the present amount of filtered water, in which case Calcutta would receive a daily supply of 16,000,000 gallons equivalent to 37.2 gallons per head. If this proposal is carried out, the supply of filtered water will be most abundant, and it will be amply sufficient for every possible want of the town so long as it keeps to its present dimensions.

The quality of the hydrant water as I mentioned before has been determined for four years, month by month, by Dr. Frankland's process of snalysis. This is certainly the most elaborate and complete method discovered, and it is believed to show the quality of a water, not only as regards its present actual constituents, but also to indicate to a certain extent, what its previous history has been. In this process it may be stated the following operations are performed: first the amount of total solids dissolved in the water is estimated, then the amounts of carbon and nitrogen present in the organic matter are determined (these are called organic carbon and organic nitrogen in the following tables); next the amount of free ammonia present (if any) is determined, and the amount of nitrogen contained in the form of nitrates or nitrites is estimated; the amount of chlorine present as chlorides is also determined, and finally the hardness of the water, temporary, permanent and total is estimated. Of these deter-

minations the second, third, fourth and fifth are the most important from a hygienic point of view. Thus the amounts of organic carbon and nitrogen represent the organic matter existing as such in the water, at the time of analysis. The ammonia may to a certain extent be due to the original ammonia we find in rain water, but more generally it may have been produced by the introduction of sewage matter into the water. The nitrates and nitrites present in water are derived from the oxidation of nitrogenous organic matter; this oxidation may have taken place either in the water itself, or in the soil on which the rain water fell. These last constituents are to be looked on with suspicion unless the water is derived from a deep well, when it may contain considerable quantities of these substances without giving rise to any alarm. It is not that nitrates in themselves are injurious in any way, but their occurrence in any quantity in river or shallow well waters shows, that the water must have been either contaminated with some nitrogenous organic matter in a state of decomposition, or in some circumstances where decomposing nitrogenous organic matter had been previously present. It is pointed out that it must be more or less dangerous to drink water that has thus been contaminated with organic matter or with nitrates derived from organic matter, for it is possible if not probable that in such a water the most noxious of all its constituents would entirely escape oxidation or any kind of change. The reason for this opinion is very clearly expressed in one of Dr. Frankland's papers on potable water. In the Journal of the Chemical Society, March 1868, at page 31 of his Memoir, he says-"There is also another aspect in which the previous sewage contamination of a water (i. e., the presence of large quantities of nitrates etc.) assumes a high degree of importance; if the shell of an egg were broken, and its contents beaten up with water, and thrown into the Thames at Oxford, the albumen would probably be entirely converted into mineral compounds before it reached Teddington, but no such destruction of the nitrogenous organic matter would ensue, if the egg were carried down the stream unbroken for the same distance; the egg would even retain its vitality under circumstances which would break up and destroy dead or unorganised organic matter. Now excrementitious matters certainly, sometimes, if not always, contain the germs or ova of organized beings, and as many of these can doubtless retain their vitality for a long time in water, it follows that they can resist the oxidizing influences which destroy the excrementitious matters associated with them. Hence great previous sewage contamination in a water means great risk of the presence of these germs, which, on account of their sparseness and minute size, utterly elude the most delicate determinations of chemical analysis." A considerable number of chemists have put forward the statement, that a river water which has

been contaminated with sewage matters will entirely purify itself in a flow of a few miles, and will thus again become fit for potable and domestic purposes. The weight of the evidence appears however to disprove this statement, and further experiments made by Dr. Frankland have shown that this oxidation of sewage matter when present in running water is a process of extreme slowness. Thus in the report of the Rivers Pollution Commissioners, he writes:

"Assuming, however, that if the polluted water had been constantly exposed to the air, a portion at least of the oxygen used would have been replaced, and assuming further that the oxidation proceeded during 168 hours at the maximum rate observed, then at the end of that time, only 62.3 per cent. of the sewage would be oxidized.

"It is thus evident that so far from sewage mixed with 20 times its volume of water being oxidized during a flow of 10 or 12 miles, scarcely two-thirds of it would be so destroyed in a flow of 168 miles, at the rate of one mile per hour, or after the lapse of a week. But even this result is arrived at by a series of assumptions which are all greatly in favour of the efficiency of the oxidizing process. Thus, for instance, it is assumed that 62.3 per cent. of sewage is thoroughly oxidized, and converted into inoffensive inorganic matter, but the experiments showed that, in fact, no sewage matter whatever was converted or destroyed even after the lapse of a week, since the amount of carbonic acid dissolved in the water remained constant during the whole period of the experiment, whilst, if the sewage had been converted into inorganic compounds, the carbonic acid, as one of these compounds, must have increased in quantity.

"Thus, whether we examine the organic pollution of a river at different points of its flow, or the rate of disappearance of the organic matter of sewage when the latter is mixed with fresh water, and violently agitated in contact with air, or finally, the rate at which dissolved oxygen disappears in water polluted with 5 per cent. of sewage, we are led in each case to the inevitable conclusion, that the oxidation of the organic matter in sewage proceeds with extreme slowness, even when the sewage is mixed with a large volume of unpolluted water, and that it is impossible to say how far such water must flow before the sewage matter becomes thoroughly oxidized. It will be safe to infer, however, from the above results, that there is no river in the United Kingdom long enough to effect the destruction of sewage by oxidation."

Thus Dr. Frankland is of opinion that a river water once largely contaminated with sewage or organic matter can never of itself become sufficiently pure again to be a safe water supply. To this point I shall again have occasion to refer, when speaking of the proposed sources of the new supply.

From these remarks it will be seen that in judging of the quality of a potable water by Frankland's process of analysis, we pay the greatest amount of attention to the amounts of ammonia and of organic carbon and nitrogen, as representing organic matter actually present, whilst we depend upon the amount of nitrates (and to a considerable extent also on the amount of chlorides as explained in the previous part of this paper) to indicate organic contamination which has become oxidized. The amounts of total solids and of Hardness although important from a manufacturer's point of view, do not seem to have any marked action on the health of persons drinking such water, except when such constituents are present in very large quantities.

Dr. Frankland has unfortunately not fixed upon any very definite standard as to the amounts of the above substances which may be present in water and yet not render it dangerous, and in fact it is almost impossible to draw any hard and fast rule; but so far as can be ascertained from his writings, Dr. Frankland appears to think that a supply which contains 0·10 parts of organic carbon and nitrogen in every hundred thousand parts of water is of "great organic purity," whilst one containing 0·30 parts of the same substances in the same volume should be considered a water of "fair organic purity." If the quantity is above this a water would be recognized as impure.

In order to give an idea of the quantities of these various substances present in the water supplies of many of the large towns in England, and to show the average composition of different samples of water from various sources, I append a table giving the results by this method of analysis of the London water supply from the rivers Thames and Lea, and from the deep wells in the chalk, also the results of the Edinburgh, Glasgow, Liverpool, Manchester and Dublin water supplies, and the average composition derived from the analysis of a large number of samples of rain water, upland surface water, spring water, and sea water. Most of these numbers are taken from the various reports of the Royal Commissioners who were appointed to investigate the Pollution of Rivers in England, but some of the numbers come from the article on Water Analysis given in "Sutton's Volumetric Analysis."

See Table, page 120.

Having thus settled our standards for comparison, we can now discuss the present water supply of Calcutta. The results obtained by the analysis of the Hydrant water are given in the following table; the numbers shown for each month are the averages for the past four years, and at the foot of the table, the general average for the whole of the four years is appended.

See Table, page 121.

Besults of Analysis expressed in parts per 100,000.

	RBMARKS.			
	Total.	21-20 21:30 28:70	02.0 0.0 0.0 0.4 0.4 0.0 0.4 0.7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0	.30 5 .80 25 .00 18.50 796.90
HARDNESS.	Permanent.	:::	40 00 00 00 00 00 00 00 00 00 00 00 00 0	4.80 9.20 7.50 7.48.00
# -	Тетрогагу.	:::	4.000000000000000000000000000000000000	1.60 11.00 48.90
	Chlorine.	1.77	0.89 0.85 1.53 0.90 1.24 0.20 10.87	0.22 1.13 5.11 2.49 1975·6
·iN	Total Combined trogen.	.238 .433	042 023 033 025 025 7 060	.203
trates	iN sa negortiN .setirtiN bns	·204 ·199 ·421	Non Do Do Do Do	000 0004 0000 0000 0000 0000 0000 0000
	.sinommA	0000	000 000 002 002 003 003 5.557	602 600 600 600 600
•0	egorii Voinegro	.033 .024	048 022 029 031 024 012 2:484	015 032 018 018 1185
	Organic Carbon.	.201 .135	203 185 210 138 138 108 4.386	.070 .323 .061 .066
.Łtj.	nqmI bilos latoT	27-26 27-79 40:26	14:10 2:40 3:40 7:00 4:30 15:80 64:50	2.95 9.67 43.78 28.20 3898.7
		London Water supply, average for 7 years. From the Thames, From the Lest, From the Deep-wells in the Chalk,	Edinburgh water supply, Glasgow water supply from Loch Katrine, Liverpool water supply, Manchester do,, Dublin do, Switzerland the Rhine above Schaffhausen, London Sewage,	Average composition of unrolluted water. Bain water 39 samples, Upland surface water 196 , Deep well water 157 , Spring water 198 , Boa water 28 ,

CALCUTTA HYDRANT WATER.

Average besults from the Analisis of four years.

Results of Analysis expressed in parts per 100,000.

	RBMARKS.													-	-	
.0	LatoT	69.9	6.48	6.61	6.79	6.24	6.23	4.48	8.67	4.34	4.7	20.9	2.48	69-99	4.00	; ;
Hardyres.	Permanent.	297	29.3	2.97	2.72	3.16	8.79	83	5 .64	800	8.82	26.2	2.93	36.17	8.08	<u>,</u>
H	Temporary.	8.72	3.56	8.64	3.07	8 0 8 9	24	1.65	0.93	1.34	1.39	3 .12	29.52	29.52	9.48	1
	Chlorine.	0.87	1.00	1.20	1.32	1.37	1.87	0.85	19.0	0.58	19.0	0.73	0.88	11:45	9.9	,
-iN I	benidmoD latoT angont	.063	Ş	111.	980	•	.054	6 63	102	960	-02	-075	.067	376.	6	<u> </u>
eotani	Mitrogen as Mi sedinik bna	.016	086	648	-034	0	·017	9	.055	946	.027	.021	025		980	;
	.sinommA	None.	Š.	å	Ď.	å	å	å	å	ů,	å	å	Ď.	å	غ ا	<u>.</u>
Tu.	egordiM oinegrO	480	.068	-063	980.	045	6	Ş	\$	9	Ģ Q	.054	9	.673	Ş	;
	Organic Carbon.	.131	.179	114	124	.120	.155	-093	.0 8 1	104	66	.118	060	1.408	115	<u> </u>
.Çdiru	uqmI bilos latoT	21.67	21.79	22.37	21.68	21.23	19.43	18.04	12:07	11.36	11.30	12.27	19.44	207.55	17:30	;
		:	:	:	i	:	:	:	:	ŧ	:	:	:	:		<u></u>
		:	:	:	:	:	:	:	:	:	:	:	:	:	;	:
		of January.	February	March,	April,	May,	June,	July,	August	September,	October,	November,	December,	÷	;	•
		Average for 1st of	Do.	Do.	å	å	å	å	Ď,	Do.	Do.	ģ	å	Sums,	Averson for year	f one of the state of

Taking the numbers representing the general average for the year and comparing them with the standards which I have suggested from Dr. Frankland's works, we find that the Calcutta water falls just outside the class of waters of "great organic purity," but that it is well within the class of waters of "fair organic purity."

Comparing again the numbers with those given in the previous table we find that the Calcutta Hydrant water though not so pure as the London waters derived from the deep wells in the Chalk, is certainly purer than the waters derived from the Thames, and perhaps also from the It is also decidedly more free from impurity than the water supplies of Edinburgh, Liverpool and Dublin, but taking all the constituents into consideration, it is not so pure as the Glasgow or Manchester supplies, or as the Rhine water above Schaffhausen. Comparing the Hydrant water with the average composition of unpolluted upland surface water as given by Dr. Frankland, we find that it is scarcely so pure as unpolluted water should be. and we are therefore compelled to admit that the Hooghly water has been slightly contaminated before it reaches Pultah. The amount of contamination is, however, not very great and as pointed out before, the Calcutta water falls well within the class of waters of medium purity. That the Calcutta water must be contaminated to a certain extent will be I think obvious to any one who is acquainted with the customs of the inhabitants of India. and more particularly of the inhabitants of villages and towns on the banks of the rivers. This contamination is a drawback to the complete safety of our water supply, for as pointed out previously, Dr. Frankland is of opinion, that a water once contaminated is always dangerous, and that the self-purification of a river which is so strongly insisted upon by certain persons is exceedingly slight. It does not however at present appear to be possible to cut off these sources of contamination, and the Hydrant water though good is not a perfect supply. Every effort however should be made to keep this previous contamination down to the lowest possible point, and it is to be hoped when systems of drainage are being introduced into the up-country towns, that the sewage from them will not be allowed to find its way into our river. Speaking generally the sewage from any one town should not be allowed to find its way into a river which is used as a source of water supply for other towns lower down.

It is not my intention to criticise these average numbers in detail, but it will suffice to say that from the absence of ammonia and from the smallness of the amounts of organic carbon and nitrogen, and of nitrates and nitrites, and also of chlorine, it is clearly evident that the contamination of the Calcutta water is really much smaller than might have been expected under the circumstances, and we may rest assured that our water supply is of fairly good quality, better in fact than that received by the majority of large towns in Europe.

In considering the results of the analysis of the Calcutta water month by month, we find that its composition varies considerably at different parts of the year. A close inspection of the table will show that apparently there are two distinct causes at work in modifying the composition of the water. The first prominent cause, and the one which has by far the greater influence, is to be found in the commencement, and during the continuance of the rainy season; the second and smaller cause appears to be the melting of the Himalayan snows by the burning sun of March, April, May and June. These changes are most clearly noticed in the column of Total Solid Impurity, and here we read that starting in January the amounts of total solids gradually increase up to March, when 22:37 parts are present in every hundred thousand parts of water; in April and May the quantities steadily and gradually diminish, the numbers being 21.68 and 21.28 respectively; this decrease continues until June 1st when there are only 19:43 parts of solid impurity present. These numbers of course correspond with the gradual and increasing diluting effect due to the admixture of pure snow water with the ordinary river water. In the middle of June, however, the rainy season usually commences, and there is a sudden decrease in the solids owing to the diluting action of the enormous volumes of rain water, and we find only 13.04 parts on July 1st; from this time there is a slight but steady decrease until October, when the water contains the smallest amount of solids present at any time of the year; the average for October 1st showing 11:30 parts. After the complete cessation of the rains (after November 1st) there is again a sudden rise in the total solids, and on December 1st, 19:44 parts are present. Some of the other columns of figures show a somewhat similar change, but in the case of the organic matter the change is not very marked. In the amount of nitrates present in the water, there appear to be two distinct maximum quantities during the year, one in March at the time of greatest concentration of the water as before mentioned, and the second at the commencement of the rains. This second maximum is readily accounted for when we consider, that the first effect of the rains will be to dissolve out the nitrates which have been accumulating in the soil of the drier parts of the country during the hot season; the amount of nitrates, however, it will be seen, steadily decreases towards the end of the rains, and this to a certain extent confirms the explanation.

Indeed during the first weeks or even days of the rainy season, the composition of our water supply is undergoing very rapid change, owing to the diluting action of the rain, and to the fact that the first showers of rain will wash out considerable quantities of soluble organic matter, nitrates etc., from the soil; afterwards, however, the rain water will run off comparatively pure. We shall therefore expect that the first action of the rain

will be to decrease the total solids, and to increase the amounts of organic impurity and of nitrates, and that afterwards all the constituents will decrease in quantity.

That such is the case may be seen by the following analyses made on June 1st, 23rd and 26th and July 1st of last year. Each of the analyses shows the gradual dilution of the water by the heavy falls of rain in the districts from which our supply is collected, and the increase of organic matter and of nitrates due to the washing out of the substances from the soil by the first showers of rain.

HOOGHLY WATER.

Results of Analysis expressed in parts per 100,000.

of Sample.	tion of	purity.	į	gen.		Nitrates	ed Ni-		н	ARDN	EAS.
Number of Sa	Date of collection Sample.	Total solid Impurity	Organic Carbon	Organic Nitrogen.	Ammonia.	Nitrogen as Nit and Nitrites.	Total Combined trogen.	Chlorine.	Temporary.	Permanent.	Total.
1	June 1st, 1879,	19.56	0.130	0.052	-000	Traces	0.052	1.32	4.24	2·45	6·79
2	June 23rd, "	17:08	0.148	0.099	-001	only. •023	0.123	0-923	3.46	3.25	6.71
3	June 26th, "	16.68	0.138	0.075	-002	.053	0.130	0.852	3.83	3·3 8	6-71
4	July 1st, "	12.48	0.113	0.093	.000	-039	0.132	0.89	0.72	4.57	5·29

Extension of the Present Water Supply.

As pointed out previously it is now proposed to double the supply of filtered water for Calcutta, and recently a proposal has been urged on the Corporation to collect the new supply of water at Cossipore or Dukhinsahar instead of as at present at Pultah. As I was consulted on this subject and gave a strong recommendation that the water should not be taken from any place near to Calcutta, but that the present source at Pultah should still be used, I may perhaps be allowed to give the substance of my arguments against the two proposed sources of supply at Cossipore and at Dukhinsahar.

My opinions on this point are to a great extent founded on some previous analyses of the river water taken at various points near to Calcutta, which were made by Dr. Macnamara and Mr. Waldie, when the Calcutta supply was first being introduced, but in addition I have myself made a few analyses which have confirmed me in my conclusions.

The usual time for pumping up the water from the river into the settling tanks is at five hours' ebb; this is of course done so as to avoid the possibility of taking in any tidal water and as far as possible to secure only the true river water. The proposals for taking the water for these two places appeared then to resolve themselves into two questions.

- (a) Whether at five hours of ebb the water off Cossipore, at all seasons of the year can be relied on as a safe source of water-supply.
- (b) Whether at five hours of ebb, the water at a distance of two or three miles above Cossipore, at all seasons of the year, can be relied on as a safe source of water-supply. For I think it will be generally admitted, if at either place, at any one season of the year, the quality of the water cannot be relied on, this would be equivalent to a condemnation of the proposed place of supply.

Before proceeding to deal with the actual results of the analyses which have been previously made by the two gentlemen abovementioned, it will be well to take a general review of the conditions of our river from which the water-supply is to be derived. The river, as is well known, is a tidal one to a considerable distance above its mouth, and it appears certain that the tidal water does not at any season of the year, or under any ordinary circumstances, reach higher than Chinsurah. I have already shown in a previous part of this paper that the true river water, as it has been delivered of late years in Calcutta, is a tolerably pure and reliable supply, and that there has never been the slightest suspicion of any appreciable admixture of tidal water with the natural river water, in the hydrant water now supplied from Pultah. This of course, is because the water is collected at a considerable distance up the river, and that it is taken at five hours' ebb.

The tidal water however, in flowing up past Calcutta undoubtedly, must become contaminated with a variety of impurities. It may be true that a large proportion, or perhaps nearly the whole of the sewage, as collected in the drains of this town, is now carried to the Salt Water Lakes, but no one, knowing the habits of the lower orders of the natives of this country, will believe, that this represents the sum total of the sewage. In all probability, there is a large amount of filth of various kinds, which finds its way direct into the river. Again, on the banks of the river numerous factories have now sprung up, and it will be quite unlike the usual experience in England if these factories, unrestrained by Acts of Parliament, do not also send a large amount of filth, refuse, &c, into the running stream beside them. I am not aware what sanitary arrangements are made on the Howrah side of the river, but it has always appeared to me, that a large amount of drainage reaches the river from that source.

Also it must be remembered that Calcutta is a large shipping port; thus on the average I believe there are about 2,000 vessels annually arriving and departing from the port, aggregating nearly two and a half millions of tons; to these must be added the very large numbers of country boats, dinghis, &c., which line the shores and which help to carry on the great and increasing trade of Calcutta. Omitting the actual business operations carried on, it must be admitted, that the crews of these vessels will add a not inconsiderable amount of sewage contamination to the river water. The tidal water, in flowing past Calcutta, must of necessity then carry with it all such contamination, and will in that state be probably, if not certainly, unfit for drinking, or even for domestic purposes.

I think it cannot be disputed that, in selecting a site from which to collect water for *drinking and domestic* purposes, it will be essential, that at all seasons of the year, at the ordinary time of collection, (five hours' ebb) there shall be practically no admixture of tidal water with river water proper; for it is evident, that the tidal water will always be contaminated with various kinds of organic matter.

The two questions which I suggested previously, thus become limited to the consideration of whether at Cossipore, or at two or three miles above it, the water at five hours' ebb is free from contamination with tidal water at all seasons of the year. It would be bad enough to supply brackish tidal water for drinking purposes, but far worse to supply tidal water, which had collected all sorts of filth and abomination on its way up.

Having suggested what it appears necessary to prove, we can now pass on to the consideration of the analyses which have been made on this point. Most of these analyses were made from 12 to 18 years since, when comparatively little attention had been given to the subject of water analysis, and an important part of the method of analysis then employed has been since shown to be eminently untrustworthy and unreliable. The suitability of a water for domestic purposes is (as pointed out previously) believed to depend principally on its freedom from organic contamination, I am sorry to say that the methods for the determination of organic matter in water, used in the old analyses under notice, have been since shown to give at the best but very rough indications, which do not at all represent the absolute amounts of organic matter present. Though these methods of analysis failed to give thoroughly reliable information, yet I do not think it too much to assume that, to a certain extent, they gave information as to comparative purity of samples of the same variety of water, and valuable information may thus be extracted from them. By this I do not mean to say that the exact proportional freedom of the water from organic matter will be represented by the figures given in these analyses,

but I do think that they may indicate that certain samples are less pure than others, and so on. For the purpose of a simple comparison, these results will be almost as useful as absolute statements, for we may work on the basis, that the good quality of our Hydrant water has been satisfactorily demonstrated.

In passing I may mention that Mr. Waldie disputes the correctness of Dr. Macnamara's results as to amount of organic matter present in the water, but it would be quite as easy for me, with a knowledge of the progress of the last ten years, to dispute the correctness of Mr. Waldie's results, so that in both cases, the results of the old analyses as to organic matter are to be accepted as comparative statements, rather than actual truths. It must be clearly understood, however, that I have no wish to under-rate the value of the work done by Dr. Macnamara and by Mr. Waldie; far from it, I believe that the results criticized are as accurate and reliable as could be obtained by the processes then known, and in those portions of the work, where the methods of analysis have not been changed, I think we may rely, with certainty, on the accuracy of the results given,

In the face of the above facts, I may be pardoned, if in considering these old analyses I draw more particular attention to the determination of the inorganic substances present, where the methods of analysis have scarcely changed, and refer less to the determinations of the organic substances present in the water.

In tidal water, that is water of which a part at least has been derived from the sea, sodium chloride, or common salt, is a prominent ingredient. In the table given on p. 120, it will be seen that sea water contains no less than 1975.6 parts of chlorine per hundred thousand of water; this substance, on the other hand, is present in very minute quantities in the true river water, and hence we have a crucial test to apply, in order to determine the presence or absence of tidal water in the samples in question. It may here also be well to remark that the process of analysis for the determination of chlorine in waters has not changed since the period when the analyses by Dr. Macnamara and Mr. Waldie were made, and therefore we may entirely rely on the accuracy of the results given as to the amounts of this constituent present in the samples of water analysed.

In the following table I quote four sets of analyses made by Dr. Macnamara of water collected, at low water in each case, from three different points in the river, namely, at Chinsurah, Pultah and off Cossipore, (one mile above Baug Bazar Bridge). For the sake of comparison I have added to the table some of the numbers obtained in the regular analysis of water for the year 1878.

Analyses of Water taken in the middle of Stream six feet from Surface.

Results expressed in parts per 100,000 of water.

	Tresuits expresses in parts pe	7 100,00	o oj wiit	<i>.</i>	
		Low WATER.	Low WATER.	Low WATER.	Low WATER
-	Constituent.	17th December 1861.	15th March 1862.	12th June 1862.	8th Soptember 1862.
in Su In	otal solid residue from filtered water rganic matter soluble earthy salts bluble salts dium chloride	26·6 6·0 16·9 3·6	27:9 5:6 19:9 1:1	••	12·9 2·6 8·0 1·5 0·8
Pultah.	otal solid residue from filtered water rganic matter soluble earthy salts bluble salts dium chloride	23·1 6·0 14·1 2·7	27·3 5·6 19.0 1·7 1·1	26·3 5·0 17·0 3·6 3·6	14·6 2 1 8·7 2·0 0·9
Todisse Sc	otal solid residue from filtered water rganic matter soluble earthy salts bluble salts dium chloride	24·6 5·0. 16·7 2·6	84·7 5·6 19·3 8·9 7·6	97·1 11·9 16·4 67·6 55·7	13:3 2:1 9:0 1:3
		1st December 1878.	1st March 1878.	1st June 1878.	1st September 1878.
To ater	otal solid residue	16.80	24.34	15.16	11-12
ti C	arbon and nitrogen of organic matter	0.158	0.164	0.111	0.124
Hydrant water.	odium chloride	1.01	1.87	1.70	0.79

An examination of this table and of the numbers given in previous parts of this paper shows clearly that the pure river water, i. e., the present

hydrant water never contains more than two or at the outside three parts of sodium chloride per 100,000 of water. This is proved by Dr. Macnamara's analyses of the water at Chinsurah and Pultah, and also by the numbers obtained weekly and monthly by myself.

When however the analyses of Cossipore water are considered, it will be seen that, whilst at low water in September and December, its composition is very similar to that of pure river water collected higher up: in March and more particularly in June, there are very striking differences. Thus on June 12th 1862 whilst at Pultah, there were only 26 parts of solid impurity and 3.6 parts of sodium chloride or salt in every 100,000 parts of water, at Cossipore (one mile above Baug Bazar Bridge) on the same day, and at low water, in the same volume there were no less than 97.1 parts of solid impurity, of which 55.7 parts were sodium chloride. This clearly indicates that on this occasion, there was a very large admixture of tidal water with the river water. Dr. Macnamara's results, as to the amount of organic matter, also appear to show that in June, there was much more present in the Cossipore water than in that collected at Pultah, and this is really what would be expected to be the case. ratio of the organic matter shown in the two instances is greater than 2 to 1, and I think that this difference must indicate that the water at Cossipore did contain an excess of organic matter over that contained at Pultah. The absolute amounts of organic matter were, we now know, very much smaller than the numbers given in the table, but we can probably rely, to a certain extent, on the relative correctness of the numbers given.

There appears then to be no escape from the conclusion which Dr. Macnamara draws in his criticism of these results when he says—"the water (at Cossipore) during March, April, May and June is largely intermixed with the saline matters of the sea water and the sewerage of Calcutta, and during that time is unfit for human consumption."

As before pointed out the sewage contamination would be very much less at the present time than it was then, but I have tried to prove that we cannot have an admixture of tidal water without at the same time having organic and sewage contamination. I have no doubt that during the rains when a powerful stream is running down, the water at Cossipore may be nearly as pure as that at Pultah, but I think that Dr. Macnamara's analyses alone prove that, during the hot weather months, the water at Cossipore is by no means pure enough to be selected as a water-supply.

Turning now to the analyses made by Mr. Waldie, it appears to me that they essentially confirm the results given by Dr. Macnamara. The water tested by Mr. Waldie was taken usually from the river at Burranagur, which is said to be two miles above Cossipore. Here on June 14th, 1866 at 11-5 A. M., (at low water) 30-7 parts of solid matter, of which 14.5 parts

were sodium chloride, were found; again on May 1866, two hours before the commencement of tide, there were 21.50 parts of salt present; on May 2nd 1866, there were 15.50 parts of salt at ebb-tide, and on June 1st 1866 at nearly low water, 16.50 parts of sodium chloride were found; these numbers being the quantities present in 100,000 parts of water.

With regard to organic matter also Mr. Waldie's results, though showing much less organic matter than Dr. Macnamara's analyses, to a great extent confirm his statements, and prove that as a rule, there is a larger amount of organic matter in the water collected at ebb-tide off Burranagur, than in the water collected at higher points of the river. The numbers above quoted show unmistakeably that at two miles above Cossipore during the hot season, there is a decided admixture of tidal water and probably of sewage contamination with the pure river water, and that this is the case even with samples collected at low water.

The opinion of Dr. Macnamara as to the suitability of Cossipore water for drinking purposes, has already been given. I will now quote Mr. Waldie's remark in his general summary of results—"Can the supply be safely taken from the river at Cossipore? We can scarcely answer in the affirmative."

In conclusion, then, I may say that, so far as can be ascertained from the old analyses by Dr. Macnamara and Mr. Waldie, and from my own results, it is my opinion—

That during the rainy season, and whilst the river is in *full* stream, the water collected two miles above Cossipore, or perhaps even at Cossipore, could probably be used as a fairly safe water-supply.

That during the hot weather months, if the water is collected two miles above Cossipore, even at five hours' ebb, there will frequently, if not always, be contamination with tidal water to an extent, which units it for a safe water-supply, and the water will be contaminated to a still greater degree if collected at Cossipore.

That this tidal contamination would involve also organic contamination to a considerable extent, and that, as pointed out in a previous part of this paper, such organic or sewage contamination cannot become oxidized or destroyed during the flow of the water, nor can the water be purified by the ordinary processes of settling, filtration through sand etc. so as to render it a safe supply for domestic purposes. Such water therefore would be eminently unsafe for potable purposes and should be at once condemned.

That unless contrary evidence is furnished, the proposed new sources of supply are too near to the mouth of the river and to Calcutta, and consequently that it is strongly desirable that the extension of the water supply should be carried out on the same principle as formerly, and that the water should always be collected at Pultah, and not at the other points which have been suggested.

IX.—On the Zoological Position of the Bharal, or Blue-Sheep, of Tibet.—By R. LYDEKKER, B. A.

(Received Jan. 4th; -Read Feb. 4th, 1880.)

The Bharal or Blue-Sheep of the Tibetan region is one of those animals which are peculiarly interesting, and at the same time peculiarly puzzling, to the naturalist, on account of its presenting affinities to two distinct groups of animals, whereby the determination of its position in the zoological scale is a matter of some considerably difficulty.

As I shall show below, the bharal presents points of resemblance both to the sheep and the goats, and this intermediate character of the animal seems to have been the cause of considerable diversity of opinion among naturalists, as to what genus the animal should be referred. The late Mr. Bryan Hodgson, in the Society's Journal,* proposed the generic name Pseudois for the bharal. Mr. Hodgson, however, together with the late Mr. Blyth, thought that there were two species of the genus, to which were given the names P. nahura and P. barhal. The latter writer, however, according to the late Dr. Jerdon, seems finally to have come to the conclusion, that there was only one species of the genus, known as P. nahura. The late Dr. Gray, and, I believe, all subsequent writers, have adopted the view of there being but one species of bharal. Hodgson's generic distinction was adopted by Dr. Gray.† The late Mr. H. N. Turner,‡ however, and Mr. W. T. Blanford,§ class the bharal in the genus Ovis, though the last named writer does not give his reasons for so doing.

In the present paper, I shall notice certain points in the osteology of this animal, which indicate its close relationship to the goats, and which, I venture to think, are sufficient to confirm its generic distinction from Ovis.

Mr. Hodgson, in his above quoted paper, first pointed out that the bharal differed from all the true sheep in having no "eye-pits," but did not point out that the absence of these "eye-pits" was a character common to the bharal and the goats.

The so-called "eye-pits" are the depressions which occur in the lachrymal bones of many ruminants for the gland known as the "larmier." In all the true sheep, the lachrymal bone has a very considerable larmial depression, and the greater part of the outer surface of that bone is placed

- J. A. S. B., Vol. xvi, p. 702.
- + Cat. of Mammalia in Brit. Mus. Pt. iii, p. 177, 1852.
- 2 "Scientific Results of 2nd Yarkund Mission," Mammalia, p. 85, Calcutta, 1874.
- § Pro. Zool. Soc. Lon. 1850, p. 176.
- I I exclude the genus Nemorhaedus from the goats.

more or less nearly at right angles to the surface of the frontals; the suture connecting the lachrymal with the maxilla is placed in advance of the suture between the maxilla and the malar. In the goats, the outer surface of the lachrymal has no larmial depression, and the greater part of such surface is continuous with the plane of the frontals; the lachrymo-maxillary and malo-maxillary sutures are in one oblique line. In the bharal, there is likewise no larmial depression on the lachrymal and the outer surface of this bone slopes gradually away from the plane of the frontals; while the lachrymo-maxillary suture is only slightly in advance of the malo-maxillary suture. In the form and relations of the lachrymal, therefore, the bharal is decidedly much nearer to the goats than to the sheep.

The next most important caprine character presented by the bharal skull, is in the basioccipital. In the true goats this bone is oblong in shape, with a pair of tubercles at the posterior and anterior extremities; of these, the posterior pair are considerably the larger and more prominent, but both are situated on the same antero-posterior line. In the true sheep, on the other hand, the basioccipital is always considerably wider in front than behind, while the anterior pair of tubercles are much larger than the posterior, and are placed wider apart. The basioccipital of the bharal agrees exactly with the basioccipital of the goats, and is, consequently, widely different from this part in the sheep.

In the form of its lower jaw, the bharal agrees with the sheep, and differs from the goats.

In the structure of its horns, the bharal again presents caprine affinities. In the true sheep the horns are always thrown into parallel transverse wrinkles extending completely round the horns; the colour of the horns is light brown, or greenish brown, and the direction of the extremity of the first curve is always downwards and forwards.

In the goats, on the other hand, the horns are never thrown into coarse and parallel transverse wrinkles, but are marked by finer striæ, and may or may not carry knobs anteriorly. Their colour is dark blackish brown: they are always more or less angulated; and the extremity of the first curve is directed backwards and upwards.

In the bharal, the structure and colour of the horns is the same as in the goats; the extremities of the horns are directed backwards and upwards: their angulation is less marked than in the goats. The horns of the bharal are indeed directed more outwards than those of the goats, and in this respect they present some points of resemblance to the sheep; the upward twist of their extremities, however, shows an approximation to the curved horn of the Markhoor and is quite different from the curve of any sheep's horn.

The profile of many goats, like the Ibex, is markedly concave; in others, however, as the Thar, it is nearly straight; the profile is also nearly straight in the sheep and bharal, and we cannot, therefore, draw any classificatory inference from this character.

In other cranial characters, there do not seem to be any well marked distinctions between sheep and goats. It, therefore, seems pretty evident that as far as cranial characters go, the bharal is undoubtedly much more closely related to the goats than to the sheep.

The bharal is, however, externally distinguished from the goats, by the absence of any odour or any trace of a beard or mane in the males. There are feet-pits (interdigital pores) in all the feet of the bharal, in which respect it agrees with the sheep, and differs from the goats, in which these pits are either absent (*Hemitragus*), or present only in the fore feet (*Capra*). The tail, according to Mr. Hodgson, is unlike that of the sheep.

From the above comparisons it will be seen that in the osteological characters of the head, the bharal is nearer the goats than the sheep, while in its external characters it is nearer to the sheep. The cranial characters pointed out above appear to me to be of such importance as to preclude classing the bharal in the genus Ovis, and I accordingly think that Mr. Hodgson's genus Pseudois should be retained for its reception. The animal most certainly forms a very closely connecting link between the genera Capra and Ovis, and it seems to be very difficult to say to which it is most nearly related.

X.—Description of a new Species of Diurnal Lepidoptera belonging to the Genus Hebomoia.—By J. Wood-Mason.

The beautiful insect described below has been recently received by the Indian Museum from the Andaman Islands, where it was obtained by Mr. A. de Roepstorff, after whom I have named it.

HEBOMOIA ROEPSTORFII, n. sp.

8. Differs from H. glaucippe, the only species of the genus with which I have been able to compare it, on the upper side, in having the apical orange patch of the fore-wing larger, extended into the cell, and less broadly bordered with black, both internally and externally; the submarginal black spots smaller and completely isolated from the black of the outer margin; the fore-wing at the posterior angle tinged, and the hind-wing externally broadly bordered, with bright sulphur-yellow, which colour is shaded off into the cream-colour of the rest of both wings; and the outer margin of the hind-wing narrowly edged with black, which gradually broadens from the anal to the anterior angle and extends inwards in points at the veins:—and, on the under side, in having the brown mottling of the fore-wing arranged in the form of a tolerably conspicuous band coincident with the macular band of the upper side; and the ground-colour of the hind-wing, as also that of the mottled portion of the fore-wing, of a rich golden-luteous colour.

Expanse 3.5 inches.

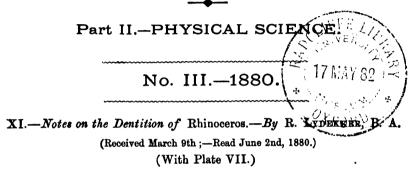
HAB. S. Andaman.

The place of this species would seem to be between *H. vossii*, (Maitland) and *H. sulphurea*, Wallace.

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ASIATIC SOCIETY OF BENGAL.



A recent examination of the dentition of the fine series of skulls of *Rhinoceros indicus* contained in the collection of the Indian Museum, has brought to my notice several very interesting facts in regard to the development and serial homology of certain of the teeth of that and other species which I have thought of sufficient importance to be put on record, whence the following notes have been penned. My remarks will mainly refer to the dentition of *Rhinoceros indicus*, but some points relating to that of other species of the genus will be incidentally referred to in the course of the paper.

To illustrate my subject, I have had lithographed (through the courtesy of Mr. J. Wood-Mason) the left upper dentition of two adolescent skulls of R. indicus, from the collection of the Indian Museum, each of which is remarkable for an abnormality. The dentition exhibited in fig. 1 of the accompanying plate belongs to a young animal, and comprises two incisors (i.1, i.2), the milk-molar series (m.m.1 to m.m.4), and the true molars (m.1 to m.3), the last of which is still in its alveolus. The second specimen (fig. 2) belongs to a somewhat older animal, and exhibits the alveolus of an incisor (i.1), two premolars (p.m.1, p.m.2), two milk-molars (m.m.3, m.m.4), and the three true molars (m.1 to m.3), the last of this series, in this instance also, not having yet cut the gum. The grounds on which these teeth are assigned to their respective serial positions will be found in the sequel.

The true molars (m.1, m.2, m.3) in all species of *Rhinoceros*, whether living or extinct, are invariably three in number, corresponding with the typical mammalian series, and, therefore, require no further notice on this occasion. In advance of the first of the three true molars, there occur, in all young skulls of *Rhinoceros*, four teeth in serial apposition, but in older skulls there may be only three. It is to these anterior teeth of the milkmolar and premolar series (the one or the other present, according to the age of the animal) to which I now desire to draw attention.

An examination of the skull of which the left dentition is drawn in fig. 1, shows that, of the four teeth (m.m.1, m.m.3, m.m.3, m.m.4) in advance of the first true molar (m.1), the three last (m.m.2, m.m.3, m.m.4) have their fangs and bases absorbed away by the germs of other teeth, which are succeeding them from above: there can, therefore, be no doubt that these three teeth are the three last milk-molars of the typical series. also shown by the last tooth of the anterior series (m.m.4) being more worn than the first of the true molar series (m,1): if the tooth preceding the latter were a premolar, it would be the less worn of the two. The first tooth of the whole series $(m.m.^1)$ shows, however, no signs of being about to be replaced by a vertically succeeding premolar. I have carefully examined another skull of the same age, in which the alveoli of the teeth have been opened, and I can find there no trace of a replacing premolar above the first of the seven teeth of the molar series. Were this tooth to be replaced by a premolar, such replacement would take place before that of the tooth next in the series. Several other adolescent skulls of R. indicus which I have examined show no trace of the replacement of the anterior tooth, and it may, therefore, be considered to be proved that in many instances no such replacement ever takes place.

From the development of the tooth in question with the milk-molar series (though it sometimes appears rather later than the next tooth), there would seem to be no doubt that it is the first of that series, and I shall show below that such is undoubtedly the case. From the fact of this tooth having in most instances no vertical successor and persisting for a considerable time during the period of use of the permanent dentition, it is not unfrequently referred to as the first premolar, and though, as I shall show, such a nomenclature is altogether inaccurate, yet it has a certain amount of convenience which may justify its conditional use.

The dentition drawn in fig. 2 also exhibits four teeth in front of the first true molar (m.1), but they are not all homologous with those in the preceding specimen. The two teeth (m.m.3, m.m.4) in advance of the first true molar (m.1) in fig. 2 are more worn than the former, and will consequently be the third and fourth milk-molars, or the homologues of the corresponding teeth in fig. 1. The first and second teeth (p.m.1, p.m.3),

however, in fig. 2 are still in germ, and as being totally unworn must be of a later development than the third and fourth milk-molars: consequently, the former must be the first and second premolars, which have replaced the first and second milk-molars. In this instance, therefore, the first milk-molar, which, as we have seen, is normally persistant, has been replaced by a vertically succeeding premolar, from which replacement there can be no question as to the correctness of the serial position assigned to the former tooth. The replacing premolar (fig. 2, $p.m.^1$.) is of considerably larger size and more complex structure than the replaced milk-molar (fig. 1, $m.m.^1$).

In the lower jaws of all the skulls of *R. indicus* which have come under my notice, I cannot find any instance of the vertical replacement of the first milk-molar, which generally persists until the permanent dentition is well in wear, and subsequently falls out at a comparatively early period. Neither can I find any instance of the replacement of the first milk-molar of either jaw in *R. sumatrensis* (sumatranus) or *R. javanicus* (sondaicus).

The formula of the molar dentition of R. indicus, taking into account the abnormal form, may be written as follows:—m.m. $\frac{4-4}{4-4}p.m.$ $\frac{(3\cdot4)-(3\cdot4)}{3-3}$ m. $\frac{3-3}{3-3}$; the adult molar dentition of the normal form, m.m. $\frac{1-1}{1-1}p.m.$ $\frac{3-3}{3-3}$ m. $\frac{3-3}{3-3}$; and of the abnormal form, m.m. $\frac{0-0}{1-1}p.m.$ $\frac{4-4}{3-3}m.$ $\frac{3-3}{3-3}$.

The succession and homology of the anterior tooth of the molar series appears to have given rise to a certain amount of confusion among naturalists. Thus Professor Huxley when treating of the dentition of the genus *Rhinoceros*, observes: "Of the four milk-molars, the first, as in the Horse, is smaller than the others, and is not replaced;" two pages back in the same work, however, the Professor gives the formula of the premolars as $\frac{4-4}{4-2}$, which would imply either that the first tooth of the molar series is replaced, or else that it is reckoned as a premolar, in which case there would be only three milk-molars.† Professor Owen appears to have come to a conclusion totally opposite to that of Professor Huxley, and seems to consider that the first milk-molar is always replaced. Thus on page 592 of his 'Odontography' the Professor observes that "the first of the

 ^{&#}x27;Anatomy of Vertebrated Animals,' p. 362.

[†] In a work explanatory of the homology of the teeth, as is Professor Huxley's, there can be no doubt that this homology should be given with the most strict accuracy. In descriptive zoology and palseontology, however, it will still be convenient, in referring to the dentition of the genus Rhinoceros, to count the first milk-molar, when persistent, as a premolar, in order to avoid introducing another term into the dental series. The same conventional arrangement may be adopted in regard to the permanent and milk-incisors, referred to below.

permanent series of seven molar teeth is very small in both jaws, and is soon shed;" and again on page 599, "the first milk-molar soon yields place to the first premolar." The above given instances of the dentition of R. indicus show that this view cannot be normally correct: the difference in the form of the first upper milk-molar $(n.m.^1)$ and the first premolar $(p.m.^1)$ shows, in cases where the former tooth persists, that it cannot be a premolar which has supplanted a milk-molar in utero, as might otherwise be the explanation according to Professor Owen's views.

I now come to the consideration of the non-molar dentition, and shall first treat of the teeth of the upper and secondly of the lower jaw.

According to Professor Owen,* there is developed in the feetal skull of *R. indicus*, immediately behind the maxillo-premaxillary suture, a very small tooth, which, from its position must be the milk-canine: this tooth disappears at an extremely early age, and no permanent successor is ever developed. I can find no record of an upper canine ever having been observed in the feetus of any other species of the genus, and no permanent upper canine occurs in any species.

In a very young skull of *R. indicus*, figured by Cuvier,† there appear in the premaxilla the alveoli of two teeth, which must be those of the first and second milk-incisors. Two, indeed, appear to be the normal number of upper milk-incisors developed in the genus, though Professor Huxley‡ speaks of there being three on either side in some species.§

Normally, in R. indicus there is only one permanent incisor developed, succeeding the first (innermost) milk-incisor; the former tooth is easily recognized by its lateral elongation. Occasionally, however, as in the skull of which the left upper dentition is represented in fig. 1, a second upper incisor $(i.^2)$ is developed, replacing the second milk-incisor. In the figured specimen, the two incisors $(i.^1, i.^2)$ are still in the condition of germs just protruding from their alveoli; from the condition of wear of the molar series it is quite evident that the two incisors belong to the second series, which is also shown by the characteristic form of the innermost $(i.^1)$; the second incisor $(i.^2)$ is not lengthened laterally like the first. In the right premaxilla of the same skull, only the first incisor is developed. Another instance of the development of the second incisor of one side of the upper jaw is afforded by the skull belonging to a mounted skeleton of an old individual of R. indicus in the Indian Museum, in which all the teeth of the permanent series are much worn. In the right premaxilla of that skull

^{· &#}x27;Odontography,' p. 592.

^{† &#}x27;Ossemens fossiles,' Ed. 1836. Atlas, pl. xliii, fig. 3.

¹ Loc. cit. p. 862.

I am not aware which species is referred to.

there occur two large and well-worn permanent incisors not differing to such an extent in size as do those of the figured specimen. No trace of a second incisor is to be found in the left premaxilla, and I cannot, indeed, find any instance of the development of the two upper incisors of both sides in the same individual of *R. indicus*. The occasional development on one side only of the second permanent incisor in the last-named species, would seem to be a pretty clear indication that it is descended from an ancestor in which two pairs of upper incisors were normally present. It seems, indeed, that, when teeth normally absent do present themselves, they usually appear only on one side, as in the instance of the lower jaw of a tiger with an extra premolar, described by myself in a former volume of the Society's Journal.

In all species of the genus, the normal number of permanent upper incisors (if any are present) appears to be one only on either side, and I have not come across any instance of the abnormal development of the second upper incisor in any species but *R. indicus*. It may not improbably be, however, that such abnormal development may occur in other species.

It has, indeed, been stated on the authority of the late Dr. Falconer† that the extinct Indian R. sivalensis was furnished with three pairs of upper (and lower) permanent incisors; none of the numerous specimens of the skull of this species figured in the 'Fauna Antiqua Sivalensis,' however, exhibit any incisors at all, and we have, therefore, no tangible evidence whatever to support the new genus Zalabis lately proposed by Professor Cope‡ for the reception of this species on the ground of the unusual number of incisors with which it was provided.

Turning now to the lower jaw, we shall find that there is some considerable difficulty in arriving at a satisfactory conclusion as to the homologies of the teeth in advance of the molar series.

In *R. indicus*, there normally exist in the young animal an inner pair of very small conical teeth, and an outer pair of larger teeth. The outer pair are succeeded from below by a pair of much larger triangular and pointed teeth, which, therefore, evidently belong to the permanent series. Normally, I believe, the inner pair are not succeeded by permanent teeth, as I can find no trace of such in most lower jaws; in the lower jaw of the skull drawn in fig. 1, however, there occurs, a little above and internal to the middle pair of teeth, a second pair of small teeth, which are less protruded from the jaw, and which, I think, certainly belong to the second dentition.

[•] Vol. xlvii, pt. ii, pl. 2.

⁺ Owen, loc. cit. p. 589.

¹ Bul. U. S. Geol. Geog. Surv. Vol. v, p. 229.

We may, therefore, say that in *R. indicus* there are always developed in the symphysis of the mandible two pairs of milk-teeth, and always one, and occasionally two pairs of permanent teeth. When the middle pair of milk-teeth are not replaced, they remain during the permanent dentition, as in the analogous case of the first upper milk-molar.

It now remains to consider the serial position of the teeth in question. With regard to the middle pair of teeth, there can be no question but that they are incisors, and probably the first of that series. With regard to the homology of the larger outer pair of teeth, two views are entertained. By the older writers, this pair of teeth were unhesitatingly classed as incisors; a view adopted both by Prof. Huxley and by Prof. Owen. terly, however, some writers, among whom may be mentioned Professors Cope* and Gaudry, + have come to the conclusion that this outer pair of teeth are really canines, apparently from their resemblance to the undoubted canines of certain genera of extinct Mammals. To distinguish between a canine and an incisor tooth in the lower jaws of animals in which the incisors are reduced and no upper canine is present, is indeed a matter of extreme difficulty, and I do not desire on the present occasion to enter into the reasons either for or against the innovation. I provisionally, however, adopt the old nomenclature. I With this view of the homology of the teeth in question, the anterior milk dentition of R. indicus may be formulated as follows:—c. $\frac{1-1}{0-0}i$. $\frac{2-2}{2-3}$, the adult dentition will be normally c. $\frac{0-0}{0-0}$ **m.i.** $\frac{0-0}{1-1}$ **i.** $\frac{1-1}{1-1}$, or abnormally **c.** $\frac{0-0}{0-0}$ **i.** $\frac{2-2}{2-2}$

In treating of the milk dentition of *Rhinoceros*, Professor Huxley§ remarks of the two pairs of lower incisors that "it seems probable that only one pair, in *any case*, are permanent teeth." I have shown that occasionally in *R. indicus* both pairs may be replaced by permanent teeth, and I now proceed to show that such is at all events sometimes the case in another species. In a lower jaw of *R. javanicus* figured by De Blainville, there are the germs of two incisors on each side *in alveolo*, below protruded incisors; the former, therefore, are clearly permanent teeth. I have no means of knowing whether this replacement is abnormal or normal. In

[·] Loc. cit.

^{† &#}x27;Les Enchainements du Monde Animal : Mammifères Tertiaries,' p. 50, et seq.

[‡] I may perhaps observe that there seems to be some discrepancy in M. Gaudry's nomenclature, since on page 58 of his work quoted above, he speaks of there being two pairs of small incisors in the lower jaw of R. bicornis (africanus), and yet does not produce any evidence to show that these teeth are not the homologues of the two pair of teeth in the mandible of R indious, which are reckoned as incisors and canines.

^{\$} Loc. cit p. 362.

^{| &#}x27;Osteographie,' Atlas, Rhinoceros, pl. viii.

R. sumatrensis, there is in the adult state no median pair of lower incisors,* and it is, therefore, probable that permanent middle lower incisors are never developed in this species.†

In the living African species of Rhinoceros, in the extinct Indian R. deccanensis, and other extinct species, no permanent incisors, in either jaw, were ever developed, and in the adult the symphysis of the mandible and the premaxillæ are consequently edentulous. It has been said that three pair of lower incisors were developed in R. sivalensis, but none of the lower jaws of the genus figured in the 'Fauna Ant. Siv.' show more than two pairs of these teeth, and none are present in the specimen referred to R. sivalensis.

From the foregoing brief notes it will be gathered that the dental system of the genus *Rhinoceros* presents very considerable differences in different species, and occasionally in different individuals of the same species. These differences are mainly due to the varying extent to which specialization has operated in the genus, and to the occasional development by 'reversion' of teeth normally absent.

The genus Rhinoceros (using the term in its original comprehensive sense) is indeed one of those in which the dental system may be said to be in a condition of change, and this variability in the matter of the development or suppression of certain teeth in species and individuals, appears to me to render the splitting up of the old genus into a number of new genera or subgenera (except in the case of Acerotherium) a very questionable measure. The relative prominence or insignificance of the anterior teeth may be traced in a graduated scale from one species to another as has been most ably done by M. Gaudry in his invaluable work already quoted in this paper.

EXPLANATION OF PLATE VII.

- Fig. 1. The left upper dentition of an immature specimen of R. indicus, showing the germs of two permanent incisors (i.1, i.2), four milk-molars (m.m.1, m.m.2, m.m.3, m.m.4), first and second true molars (m.1, m.2), and the alveolus of the third (m.3). (The animal to which this skull belonged was killed by Mr. W. T. Blanford.)
- Fig. 2. The left upper dentition of a somewhat older individual of the same species, showing the alveolus of the first permanent incisor (i.1), the first and second premolars (p.m.1, p.m.2), the third and fourth milk-molars (m.m.3, m.m.4), the first and second true molars (m.1, m.2), and the alveolus of the third (m.3).

Both specimens are drawn one half the natural size.

- Professor Cope (loc. cit. p. 229) is in error when he gives two pairs of mandibular teeth to this species.
- + I should doubt if the lower jaw drawn in fig. 15 of plate 188 of Owen's 'Odontography' as of R. sumatronsis belongs to that species.

XII.—On a Species of Trochalopterum from Travancore. By W. T. Blanford, F. R. S.

(Received Sept. 2nd; -Read November 3rd, 1880.)

A very interesting series of bird-skins obtained in Southern Travanceore has recently been brought to England by Mr. F. W. Bourdillon. Collections previously made by the same gentleman in the locality named have been described by Mr. Hume in Stray Feathers, Vol. IV, p. 351, and Vol. VII, p. 33. One of the species noticed in the second paper is *Trockalopterum fairbanki*, a bird originally obtained by Mr. S. Fairbank on the Palni hills, about 100 miles north of the range, east of Trevandrum, on which Mr. Bourdillon's skins were collected. Mr. Hume, l. c. p. 37, points out some differences between the Travancore and Palni forms, but remarks that he has not a sufficient series to determine whether these differences are constant.

In the collection now brought are three skins of the Travancore Trochalopterum, and on comparing them with the original type of T. fairbanki in the British Museum, I find, besides the differences noticed by Mr. Hume, a few other distinctions, sufficient, I think, to justify a separate title being bestowed on the Travancore bird. The following is a full description of the latter.

TROCHALOPTERUM MERIDIONALE, sp. nov.

T. Trochaloptero fairbanki peraffine, sed dorso grisescente, abdomins medio albo, supercilio albo haud post oculum producto, regione postoculari grisea nec fusca, rostroque robustiore distinguendum: pileo brunneo, dorso griseo-olivaceo, postice olivaceo, coloribus transeuntibus; supercilio brevi albo, loris brunneis, cum pileo concoloribus; capitis lateribus cum regione parotica pallide rufescenti-griseis, colli lateribus cinereis; rectricibus remigibusque brunneis, illis remigibusque secundariis ultimis subobsolete transfasciatis; mento, gula, atque pectore albescenti-griseis, conspicus fusco-striatis, media gula fere alba; abdomine medio albido, lateribus cum pennis subcaudalibus tectricibusque inferioribus alarum ferrugineis, tibiis olivaceis; rostro nigro, pedibus fuscis, iridibus saturate rufis.

Long. tota exempli masculini 9, alæ 3.5, caudæ 3.6, tarsi 1.45, rostri a fronte 0.8, ejusdem a rictu 1, culminis 0.9 poll. Angl.

HAB. In summis montibus provinciæ Travancore, ad extremitatem meridionalem peninsulæ Indicæ.

Head above hair-brown, the feathers rather pale-shafted, the colour passing gradually into that of the back, which is greyish olive, becoming greener on the rump; a very short white supercilium, only extending from

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the base of the bill to above the middle of the eye; lores the same colour as the crown; sides of head, including the ear-coverts, grey, with a slight rufescent tinge; sides of neck purer grey; wing and tail-feathers brown with olivaceous margins, all the tail-feathers and the last (proximal) secondary quill-feathers with faintly marked narrow transverse bars on the upper surface; chin, throat, and breast pale grey, with conspicuous dusky striss, the central portion of each feather being much darker than the edges; the middle of the throat is very pale, almost white, middle of abdomen white, lateral portions and flanks with the under tail-coverts and under wing-coverts ferruginous; thigh-coverts olivaceous. Irides dark red,* bill black, legs dusky.

The three specimens were all shot at an elevation of 4000 feet. Two are from Mynall, one from the Travancore and Tinnevelly boundary. Two are males; of the third, the sex has not been ascertained. The differences in measurement are trifling: the wing is 3.4 to 3.55 inches; tail, 3.4 to 3.65; tarsus, 1.4 to 1.45; culmen, 0.9 to 0.95. The length is given by Mr. Bourdillon from 8½ to 9½ inches in different specimens.

T. meridionale is distinguished from T. fairbanki by (1) the much shorter white superciliary stripe terminating above the eye, whereas, in T. fairbanki, it extends back above the ear-coverts; (2) by there being no brown band behind the eye, the feathers immediately behind the eye being rufescent grey like the cheeks in T. meridionale, whilst they are brown like the lores and the crown in T. fairbanki; (3) by the back and upper parts generally being much greyer and by the brown colour of the crown passing gradually into the olivaceous tinge of the back and not being separated by a distinct margin; (4) by the tail-feathers being browner and more distinctly transversely barred above; (5) by the striation on the throat and breast being more strongly marked; (6) by the middle of the abdomen being white instead of ferruginous; and (7) by the rather stouter bill. I consider the differences marked 1, 2, and 3 characteristic; the others taken alone would scarcely justify the separation of the two forms.

From T. jerdoni the present species may be known by the absence of a black chint, by the flanks and under tail-coverts being rufous instead of

Noted by Mr. Bourdillon, as also are the dimensions taken in the flesh. The length above quoted is from these measurements.

[†] This may not be constant; I have an indistinct recollection of having seen a specimen of T. fuirbanki with the middle of the abdomen whitish, but I am not sure.

[‡] With reference to this distinction between *T. jerdoni* and the two Southern forms *T. fairbanki* and *T. meridionale*, it is as well to note that the presence of a black chin in the former is mentioned by Blyth in his original description J. A. S. B., 1851, xx, p. 528. I call attention to this distinction, as Mr. Hume has overlooked it in his note on the species (Stray Feathers, vii, p. 36).

olivaceous, and the middle of the abdomen white instead of rufous. It is greatly to be regretted that T. jerdoni has never been collected again, so far as can be judged by published accounts, since Jerdon first procured it.

XIII.—On a new Species of Papilio from South India, with Remarks on the Species allied thereto. - By J. WOOD-MASON, Officiating Superintendent, Indian Museum, and Professor of Comparative Anatomy and Zoology, Medical College, Calcutta.

(Received Oct. 16th; -Read Nov. 3rd, 1880.)

(With Plates VIII and IX.)

In December last, the Indian Museum received from Mr. F. W. Bourdillon of Trevandrum, a small collection of diurnal Lepidoptera, amongst which was a much worn and tattered example of a female insect evidently closely allied to the North Indian P. Castor and to the Burmese P. Mahadeva, with the same sex of the latter of which it turned out on examination to agree in having the discal markings of the hind-wing confined to the median region of the organ, where they form a transverse band of lanceolate spots, instead of being diffused over the whole disk and extending into the cell, as in the former.

About a month ago, a few species of butterflies were received from Mr. G. H. Kearney of the Berkodee Coffee Estate, Koppa Anche, Mysore, and amongst them is a fine specimen of the male, which proves that the species is, as the above-mentioned female specimen had already indicated, more nearly related to P. Mahadeva than to P. Castor, and enables me to describe it.

Papilio Dravidarum, n. sp., Pl. VIII, Fig. 1, 8.

Allied to P. Castor and to P. Mahadeva, t but more closely so to the latter, with which it agrees in the form of the wings in both sexes.

Sexes alike, having not only the same form of wings but also the same general type of coloration as the females of the two described species; the male differing from the female only in the darker and richer tints of its upper surface.

3. UPPERSIDE rich fuscous of a much lighter shade than in P. Castor, or even than in P. Mahadeva, and more densely powdered with fulvous scales than in either. Anterior wing with the basal area of a richer and darker shade of brown than the rest of the organ; with four distinct longitudinal lines of fulvous scales in the cell, at the extremity of which is a minute but distinct cream-coloured speck; with the outer portion beyond

[•] Moore, P. Z. S. 1878, p. 840, pl. li, fig. 1.

the cell very densely covered with fulvous scales between the veins; with a marginal row of ochraceous-white spots placed at the incisures; and with a submarginal series of nine conical or sublanceolate ochraceous ones: each series decreasing at either end and paling towards the costal margin. Posterior wing with the anterior third of its surface devoid of fulvous scales: with the incisures of the outer margin very narrowly edged with ochraceous-white: with a sub-marginal series of seven strongly and angularly curved lunules or arrow-shaped spots, the four posterior of which are ochraceous-white, and the three apical ones cream-coloured; and with a discal band of seven externally-dentate lanceolate cream-coloured spots all irrorated with fuscous scales except the anterior two: with the cell and the parts of the wing-membrane external and internal to it tolerably thickly sprinkled with fulvous scales. The wing-membrane being in both wings devoid of fulvous scales in the intervals between the sub-marginal and incisural markings presents the appearance of having a sub-marginal row of dark blotches. UNDERSIDE less richly and deeply coloured, with the markings. especially the spot at the end of the cell, all slightly larger and white, with the exception of the discal series of the hind-wing, which are tinged with cream-colour at their inner points; and with the fulvous scales similarly though not quite so thickly distributed over the fore-wing, but evenly sprinkled over the whole of the hind-wing. Body lighter-coloured than in P. Castor, but marked in identically the same manner.

Length of fore-wing 2.2; whence expanse = 4.5 inches.

HAB. Koppa Anche, Kadur District, Mysore, S. India, at about 2,500 feet elevation. Obtained by Mr. G. H. Kearney.

2. Marked above and below, spot for spot, as in the male, but lighter and less richly coloured, with the spot at the end of cell larger and apparently more distinctly visible on the upper side, and with all the markings (except the sub-marginal series of the underside of the hindwing, which are white) straw-coloured.

Length of fore-wing 2.8; whence expanse = 4.7 inches.

HAB. Trevandrum. Obtained by Mr. F. W. Bourdillon.

In the male of *P. Dravidarum*, there are visible upon the upper surface of the fore-wing a spot at the end of the cell, a sub-marginal row of conical or sub-lanceolate spots, and a marginal row of incisural spots; and upon that of the hind-wing a discal row of lanceolate spots, a sub-marginal series of lunules, and incisural spots as in the fore-wing.

In the male of the darker-coloured *P. Mahadeva*, the incisural spots of the fore-wing alone remain, but the hind-wing retains its three series of spots, which, however, are all smaller and apparently less clouded with dark scales than in the preceding species.

In the fuscous-black male of *P. Castor*, the fore-wing may be said to be uniform black, the incisural spots, which alone remain, being so reduced

in size as to be barely visible, being, in fact, mere specks confined to the fringe; the hind-wing has lost all but the incisural specks (which are similarly confined to the fringe) and the first three or four spots of the discal series, which together form a large and conspicuous cream-coloured blotch divided by the veins: *P. Castor* may, in fact, be described as a rich dead-black insect with a conspicuous cream-coloured blotch near the outer angle of each hind-wing.

In P. Castor, then, the sexes are, as regards colour and markings, as strongly differentiated from one another as in any species with which I am acquainted; they also differ to some extent in form, the male having the fore-wing narrower, with the external margin obviously emarginate, and the hind-wing also narrower and produced, with the same margin more deeply incised and lobed than in the female, both pairs of whose wings in form more or less closely* resemble those of both sexes in the other two species.

In P. Mahadeva, the sexes are also tolerably well, though not so conspicuously, differentiated in point of colour and markings as in P. Castor, but not at all in form, the wings being of the same shape in both sexes.

In P. Dravidarum, the sexes agree perfectly both in form of wings and markings, differing very slightly in colour only; so that but little sexual differentiation has here taken place.

The female of *P. Dravidarum* is scarcely distinguishable, as far as one can tell from a description alone, from that of *P. Mahadeva*, the only differences that I can make out being that in the latter "the fore-wings have very small and less distinct sub-marginal white spots, and no spot at the end of the cell." From that of *P. Castor*, however, it is readily distinguished by having, as I have already pointed out, the discal markings of the hind-wing in the form of a transverse band of short lanceolate spots.

At the meeting of the Linnman Society of London held on the 18th March last, a paper by Prof. Westwood, on a supposed polymorphic butterfly from India, was read. In this memoir the following conclusions are said (vide abstract in 'Nature' Vol. XXI, p. 531, April 1st, 1880) to have been arrived at by the author:—(1) "That Papilio Castor is the male of a species whose females have not yet been discovered; (2) that the typical P. Pollux are females of which the males with rounded hind-wings having a diffused row of markings has yet to be discovered; and (3) that the coloured figures given by the author represent the two sexes of a dimorphic form of the species."

[•] The females present an inconspicuous dimorphism, some having retained the primordial form of hind-wing, while others have the outer margin of this wing toothed as in the male (vide infra).

With regard to the last of these conclusions I cannot speak, because neither the paintings nor the specimens in question are accessible to me; but, having spoken above as if the opposite sex of *P. Castor* were perfectly well-known to naturalists, while, according to Prof. Westwood, it is still undiscovered, I ought perhaps to say a few words about the material on which my remarks are based.

Papilio Castor is restricted in its distribution to the slopes and valleys of the hill-ranges of North Eastern India and to the parts of the plains in immediate contiguity with them; its place being taken elsewhere, as in Southern India, by the new species described in the preceding pages, and, in Burmah, by P. Mahadeva. The Indian Museum possesses specimens from the Southern slopes of the Khasi Hills (Silhet), from the Sikkim Hills (Darilling), Cherra Punji in the Khasi Hills, and the Naga Hills: and three males were taken by Lieut.-Col. Godwin-Austen during the Dafla Expedition; in these last, in a large male from Cherra Punii, and in two specimens of the same sex from the Naga Hills the upper surface is dark brown of a much lighter tint than in nine males recently received from Sikkim (2) and Silhet (7), which are all brown-black of so dark a shade as to appear quite black except when a strong light falls upon them when their colour appears brownish; in fact, the brown of the former is to that of the latter series of specimens what dark green is to the colour known as "invisible-green." In the large Cherra Punji specimen, the short tooth. or rudimentary tail, into which the third branch (d.3, pl. ix, fig. 1) of the median vein of the hind-wing is usually produced, does not extend beyond the line of the other lobes of the outer margin, and one of the three dwarfed winter specimens* captured by Col. Austen approaches it in this respect: moreover, one of the Silhet specimens has this tooth smaller in one wing than in the other, so that this, like secondary sexual characters in general. is subject to variation. It is possibly to difference of station, but probably to long exposure to the vicissitudes of the Calcutta climate, and to the applications of benzine and other noxious substances to which they were subjected before I took over charge of the collection of Lepidoptera, that these brown specimens owe their lighter coloration. However this may be. it may confidently be asserted that it would be impossible for the most inveterate species-maker to discover any character by which to separate them as a distinct species or race from the fresh and consequently dark Sikkim and Silhet specimens. So much for the males.

Of the nine females in the collection referred by me to P. Castor, seven being perfect can readily be divided into two sets according to the form of the outer margin of the hind-wing—three (one from Assam, one

[•] The insect figured by Westwood (Arcana Entom. vol. ii, pl. 80, fig. 2) seems to have been a similarly dwarfed and faded individual.

from Cherra Punji, and a large one from Silbet) having the third branch (d.3, pl. viii, fig. 2) of the median vein not produced and the outer margin of the wing consequently 'rounder,' being, in fact, typical P. Pollus—and four (two from Silbet† and two from Sikkim‡) having that veinlet produced into a small tooth (d.3, pl. ix, fig. 2) as in the male. I consider that these two different forms are both females of P. Castor, and that the slight differences they present are explained on the supposition, warranted by numerous analogous facts in nature, that the secondary sexual characters acquired by the male have been partially transmitted to some females but not to others (P. Pollux), which have retained the primordial rounded form of wing.

The fact that the discoidal markings of the hind-wing in the two Silbet females with toothed wings are lighter and more distinctly cream-coloured than in any of the females with rounded wings; that the malformed specimen from the same locality (which certainly belongs to the form with toothed hind-wings) has these markings in the fourth, fifth, and sixth interspaces, those, that is to say, corresponding to the ones forming the principal part of the blotch in the male, of almost as rich and pure a colour as in that sex; and that one of the two former has the spot at the end of the cell and the submarginal markings of both fore-wings obsolete and is thus still further approximated to the male; do certainly seem to me to tell rather for than against the above supposition.

The Helenus-group of Papilios, to which Papilio Castor and its allies

- There is another specimen from Cherra Punji, the largest of all in the collection, with the outer margins of its hind wings so ragged that it is impossible to be quite sure to which form it belongs, though, from its close agreement in other respects with Westwood's figure in the 'Arcana' as well as with the other insect from the same locality, I should say it is a typical P Pollux.
- † There is a third specimen from Silhet in the collection, taken at the same time and place as the other two, but it unfortunately has the hind-wings symmetrically malformed at their outer margins, the third lobule on each side being short and angulated and the fourth being somewhat longer than usual and also angulated. This malformation is interesting as showing in the same specimen the instability of this character, the strong tendency to the assumption of the male form of wing exhibited in the lengthening of the lobule next in order, and the unmistakable 'reversion' to the rounded form of wing in the suppression of the rudimentary tail.

It should be mentioned that a gynandromorphous example of the form of female described by Prof. Westwood as P. Pollux has been figured and described as P. Castor by G. Semper in Wien. Entom. Monatschr. 1863, Band vii, p. 281, Taf. 19. In this specimen both the wings of the left side are truly female, but on the opposite side the posterior portion of the fore-wing from the first discoidal veinlet to the inner margin on the upper side only, and the anterior portion of the hind wing from the costal margin to the second branch of the sub-costal on both sides, exhibit the masculine livery not unmingled with female characters (Conf. Westwood in Thes Ent. Oxon. p. 187).

‡ The two Sikkim specimens have the tooth less developed and the discal markings of the hind-wings exactly like those of the other form (P. Polluz).

unquestionably belong, taken as a whole, presents us with a remarkable series of gradations in the amount of difference between the sexes, comprising as it does: one species (P. Dravidarum) in which the sexes closely resemble one another in the form of the wings and in colour and markings, and there is only an incipient sexual differentiation: another (P. Mahadeva) in which, while agreeing in structure, they differ to a considerable extent in markings and colour, and the secondary sexual characters of the male are much more pronounced: another (P. Castor) in which they differ from one another to such a remarkable extent that no lesser an authority than Prof. Westwood originally described them under different names and still maintains their distinctness, and Mr. Wallace* placed them in different groups of the genus; the male having acquired the most pronounced secondary sexual characters (including rudimentary tails), which have been partially transmitted to some females but not to others; and the two forms of female having retained, one of them the form of wings, and both the general style of colouring, characteristic of both sexes in the firstnamed species: and, finally, others (P. Helenus, P. Chaon, etc.) in which the male has perfectly transmitted to the opposite sex all the secondary sexual characters (including the long tails) that he had acquired, the female only differing from him in such trifling points as the lighter coloration of the outer half of both wings and the dingier shade of her upper surface generally.

From these and other facts, we are, I think, entitled to infer the probable descent of all the members of this group from an ancestor with tailless, rounded wings in both sexes, closely resembling P. Dravidarum, but with diffused discal markings in the hind-wings and probably also in the fore-wings; the conspicuous wing-blotches of P. Helenus, P. Castor, etc., having apparently resulted from the concentration, so to speak, of such diffused colouring in the direction of the breadth of the wing, just as have the discal bands of short spots in P. Dravidarum and P. Mahadeva from a similar process of modification in the opposite direction.

If his conclusions are correctly reported, Prof. Westwood's drawings must represent a species different from either of those alluded to herein, and I look forward with much interest to the appearance of his paper.

EXPLANATION OF THE PLATES.

Plate VIII.

Fig. 1. Papilio Dravidarum, W.-M., &.

Fig. 2. Papilio Castor, Westw. Q 2nd Form (P. Pollux, Westw.), from Silhet.
Plate IX.

Fig. 1. Papilio Castor, Westw. &, from Silhet.

Fig. 2. \bigcirc ? 1st Form, from Silhet. $d.^3$ = third branch of the median vein.

[•] In his well-known memoir 'On the Phenomena of Variation and Geographical Distribution as illustrated by the *Papilionids* of the Malayan Region' in Trans. Linn. Soc. Lond., vol. xxv, pp. 33, 34.

XIV.—Description of the Female of Hebomoia Roepstorshi. By J. WOOD-MASON.

(Received October 27; -Read November 3rd, 1880.)

HEBOMOIA ROEPSTORFFIL

H. Roepstorffii, Wood-Mason, antea, p. 134, 3.

UPPERSIDE. Fore-wing with the orange patch devoid of amethystine gloss, externally more broadly bordered with fuscous (which at each veinlet gives off inwards an angular process the extremity of which is continued on as a very narrow edging to each side of the veinlet), but internally much less distinctly so than in the male; with the cell more clouded with dark scales; and with the sulphur-colour at the inner angle more Hind-wing with a marginal row of large subtriangular fuscous spots placed upon the veinlets from the first subcostal to the first median (the two last obsolete), decreasing from the second in the direction of the anal angle, and connected together at the extreme margin of the wing by a narrow edging of the same colour, which extends to the anal angle: with a submarginal series of six roundish spots, similarly decreasing from the first, and alternating with those of the marginal series, each being placed upon a fold, the first and largest on the fold between the costs and the first branch of the subcostal, and the last on that between the first and second median veinlets; and with the sulphur-colour around the four intermediate submarginal spots stained with orange. Underside of both wings paler.

Length of fore-wing 1.7; whence expanse = 3.5 inches.

HAB. South Andaman.

Described from a specimen in the collection of Captain G. F. L. Marshall, R. E., who courteously offered me the loan of the insect for description as soon as he had seen the description of the male published in the last number of this Journal.

In Captain Marshall's specimen of the male the submarginal spots of the fore-wing are obsolete.

XV.—Notes on and Drawings of the Animals of various Indian Land Mollusca (Pulmonifera).—By LIEUT.-Col. H. H. Godwin-Austen, F. R. S., F. Z. S., &c.

(Received July 15th;—Read Nov. 3rd, 1880.)

(With Plates X and XI.)

Previous to his appointment to the Yarkand Mission, Dr. F. Stoliczka had been working for some years at the animals of the Indian land Mollusca, and had enriched this Journal with many valuable papers. Among the numerous MSS. he left behind him in Calcutta, there were found, after his death, some very excellent drawings that had been made under his superintendance from the living animals; they had been drawn on scattered sheets of paper, and remarks on the colour and other characters of the soft parts had been made in pencil on the margins, which were fast becoming illegible. I, therefore, with the concurrence of Dr. J. Anderson, pasted these interesting drawings into a scrap-book* and copied into it, as well as I was able to decipher them, the names, localities, and remarks noted.

As it may be some years before many of these species are obtained again by any naturalist with the means or talent to correctly draw them, I have thought that lithographed copies published in this Journal would not only be preserving, but in a measure carrying out the work of so good an observer, and would be of use to those in India who are interested in the land-shells of the country. There is an immense amount of work to be done in this particular branch of Natural History. We know as yet very little of the relationship of the many species, especially among the Zonitidæ (Semper); the anatomy of most of them has never been examined, and, until this is done, or at least more careful descriptions and sketches of the outward form of the animals are made, our attempts at a satisfactory classification must fail.

I have to each species figured given Stoliczka's remarks and identifications in full, and added a few notes extracted from my field-book wherever I could do so, and I also distinguish a few identifications by Messrs. W. T. Blanford and Geoffrey Nevill.

The plates that will be given contain species of the family Zonitidæ variously assigned to the genera Ariophanta, Hemiplecta,† Rhysota, Xesta, and Rotula; and one plate has been required for the Helicidæ of such very different genera as Plectopylis, Fruticicola, &c; those of the genus Macrochlamys, I have also copied, but as I am engaged on a paper treating of this group more in detail, which I propose to send to the Zoological Society of London, the plate will I hope appear in the Journal of that Society.

[•] In the Library of the Indian Museum, Calcutta.

[†] Oxytes.

Genus ARIOPHANTA, Des Moulins.

Bull. Soc. Bord. III, p. 227, (Nov. 1829).

With plate giving three figures of shell and two of the animal from life; type lævipes, Müller, Bombay.

The description by Albers (Die Heliceen, p. 62, 1860) is as follows: "Testa sinistrorsa, umbilicata, tenuis, diaphana; anfractus ultimus angulatus vel carinatus; apertura obliqua, lunaris, peristoma simplex, acutum, margine columellari reflexo"; in the sub-genus, thus defined by shell alone, this writer places the following species:—

<u> </u>	
himalayana, Lea = interrupta, Bs.	Bengal.
lævipes, Müll.	Bombay.
retrorsa, Gould (Hemiplecta, Sect. E of The	eobald) Tavoy.
janus, Chem.	Malacca.
rumphii, v. d. Busch.	Java.
Adams adds to these:	
ryssolemma, Albers (? Thyreus, Bs.)	Java?
trifasciata, Chemn, = lævipes, var.	Malabar.
and he figures lævipes, quoting M. E. Gray, Fig. 7, which is a trace of Des Moulins' original drawin	
, which is a trace of your accounts of Since account	

Mr. Geoffrey Nevill, in his Hand-List of Shells in the Indian Museum Calcutta, adds to the above:—

laidlayana, Bs. kadapaensis, Nevill. Lower Bengal. Madras.

= nicobarica, Chemn. re-named, as it is not found in the Nicobar Islands.

cysis, Bs. thyreus, Bs. Nilgiris.

intumescens, W. T. Blf.

Nilgiria Bombay.

immerita, W. T. Blf. (in coll. Beddome) South Canara

near *interrupta*.

cambojensis, Reeve regalis, Bs. Siam. Borneo.

= vittata, Adams and Reeve, (vide Adams. Gen. Moll. pl. lxxix, fig. 5, as Nanina).

bajadera, Pfr. = ammonia, Valenciennes

Bombay.

Mr. William Theobald (Cat. Land and Freshwater Shells of Brit. India) includes—

auris, Pfr. (? cysis, Bs.)

Kundah Hills, Madras.

cyclotrema, Bs. Sumeysar Hills, North of Tirhoot a true Helia belonging to the delibrata-group.

foveola for foveata, Pfr.

Java.

Mr. Edgar Smith agrees with me, on a comparison of the species in the British Museum, that this is rumphi, Mus. Cuming.

saccata, Pfr.

Tavoy.

and this is only the young of retrorsa, Mus. Cum.

Dr. C. Semper (Reis. Arch. Philip. p. 50, 1870), on the character of the horn above the tail-gland and foot, places one sinistral species (*rumphi*, v. d. Busch.) and the following dextral shells in the sub-genus:—

martini, Pfr.

Sumatra.

nemorensis, Müll.
javanica, Lamark
rareguttata, Mouss. (Xesta)
striata, Gray (Nanina)
atrofusca, Albers.

Java.
Adenare, near Timor.
Singapur.
Singapur.

It is very unlikely that these last six species from the islands of the Malay Archipelago have any very close relationship to the typical sinistral Bombay species *lævipes*, although the tail-gland does assimilate, and it would be better to keep them, as well as all the other species from the same region, separate for the present, as nothing is yet known of the anatomy of the Indian species. Only those purely Indian forms which I distinguish by antique type can be with certainty placed in this sub-genus.

Pfeiffer has also, besides typical forms and others (Zeits. 1855):—

ammonia, Valenciennes, (sp. in Brit. Mus.)

Habitat?

regalis, Bs., (I do not consider should be included.)

sannio, Pfr.

ampullarioides, Reeve (Mus. Taylor — cysis.)

Nilgiris.

linstedti, Pfr. (Mus. Cum.)

Malacca.

is closely allied to *rumphi*, but it is sharper keeled, and, if the latter should prove a true *Ariophanta*, it should also be included.

Des Moulins founded his genus on the animal of a specimen which had been sent to him alive from the island of Elephanta, Bombay, by M. Théophile Laterrade in March 1829. The mollusk lived some short time and two drawings of it were made. Previous to this the shell only had been described by Müller.

To M. Des Moulins, therefore, belongs all the credit of first noticing and distinguishing the very distinct and large group of Asiatic Helices possessing a mucous pore at the extremity of the foot, and for which group so characterized he proposed the title PHEREFORE, placing the Bombay shell in his sub-genus Ariophants.

Dr. J. E. Gray four years afterwards, on the similar characters of another but very distinct species, created the genus Nanina, for Asiatic

Helices of this type, and his genus was adopted by Adams and others, although Thos. Hutton first, and Benson afterwards, had pointed out the distinction in the sub-genus Macrochlamus; I do not, therefore, see how in fairness and by all rules of nomenclature Mr. Gray's title can be adopted, as it has been, for the whole group (Indian and Malayan) of these Eastern Helices provided with a mucous pore which Des Moulins described so well and so accurately; the latter saw at once the important differences such an organ implied in the general anatomy of the animal and understood its great value in classification, and he shewed also its affinity in this respect to Arion by the title he gave it (vide, pp. 230, 235, where he gives in full the description of the animal, his remarks on which are well worthy of perusal).

H. (ARIOPHANTA) LEVIPES, Müll., var. TRIFASCIATA, Chemn. Pl. X. Fig. 3, 3a.

H. lævipes, Müller, Hist. Verm. 2, p. 22, no. 222.

" --- Gmelin, Syst. Nat. p. 3616, no. 13.

,, — Chemnitz, Conch. 9, t. 108, fig. 916.

" ---- sub-genus, Hélicelle, 2me group Aplostomes, 3me Sect. rubannées.

" - Férussac, Hist. Moll. pl. xcii, fig. 3 à 6.

" — Férussac, Tabl. Syst. p. 41, no. 229.

Sub-genus Ariophanta, Des Moulins, var. a. all white, without bands, from Island of Elephanta; var. b, c. banded, from the same locality (only this banded var. trifusciata figured in the Conch. Ind. pl. cxxxi, fig. 4.)

The figures are taken from No. 57a and 57b of the MSS. drawings representing specimens from Bombay.

ABIOPHANTA INTERRUPTA, Bs., Pl. X, Fig. 1, 1a.

Helix interrupta, Bs. Zool. Jour. Vol. V, p. 461, (1834), from Sikrigalli and on the Jellinghy river (tributary of the Ganges).

= Himalayana, Lea.

These figures have been reproduced from No. 44 in MSS. in Ind. Mus. Library; the specimens from which the original drawings were made were obtained in the Botanical Gardens, Calcutta.

Benson's description of this last in above Journal applies to H. lævipes, but in his description of the animal, he says the excrements are "voided from an opening in the terminal and posterior part of the foot instead of from the foramen commune" he must here evidently be mistaking the mucous gland for the anal orifice, although on the previous page (460), describing the genus Nanina, he shews that they are distinct openings.

H. — Conch. Ind. Hanley, fig. 3, plate xxvii. Specimens from Fagirabunda, Jessore District, are thus described in my note-book-"The animal being of a pink colour the same tint is given to the shell, while black mottlings show through the body whorl. The head is dark-coloured up to a well defined black line (extending from posterior part of the neck to below the oral tentacles), thence light-coloured with a pink tinge, which

is more intense near the extremity of the foot. The mucous gland has the form of a long slit with a very small lobe above."

HELIX (ARIOPHANTA) LAIDLAYANA, Bs., Pl. X, Fig. 2.

Ann. Nat. Hist. Ser. 2, Vol. 18, (1856) p. 253.

The figure is a copy of fig. 30 of MSS. drawing of a specimen from Manbhum.

Helix laidlayana, Bs. Hanley, Conch. Ind. Pl. lviii, fig. 3, 4, 5: figure 4, from Cuttack would appear to be a different species from fig. 3, Orissa, which agrees with the original description, fig. 5.

H. (ARIOPHANTA) INTUMESCENS, W. T. Blf. Pl. X, Fig. 4.

J. A. S. B. 1866, p. 33, type from Mahableshwar, Western Ghats of Hindustan.

The figure is from fig. 17 of MSS. drawings and bears the following remark "N. Canarica from Fairbank" [Stoliczka].

Mr. Blanford writing of the animal and comparing it with bajadera says—"The animals also shew a difference in colour, that of intumescens is uniformly, so far as I have seen, dark cinerous, while that of bajadera is much lighter, but very variable. The latter shell is found mostly on shrubs, the former on the ground, and while intumescens has as yet only been found at Mahableshwar 4,500 feet above the sea, bajadera (which is rare at Mahableshwar) abounds on the equally or nearly equally high hills of Singhur and Poorundhur, and along the summit of the Western Ghats at about 2000 feet. It abounds at Khandalla at the top of the Bore Ghat."

Genus HEMIPLECTA, Albers. Die Heliceen, p. 60, (1850).

Founded on the shell alone; type humpfreysiana, Lea, from Singapur. "Testa supra granulosa vel decussatim striata; subtus polita, anfractus ultimus plus minusve angulatus vel carinatus."

Albers gives for the distribution of the species of this group the large islands of the Malay Archipelago, Java and the Philippines, New Ireland, &c.; only one species labiata (= monticola, Hutton) being from India, and that not agreeing with the description, the last whorl being well rounded. The two characters given would embrace a vast number of species having a much wider geographical range, and I should be inclined to restrict it to the Malay region and not to include any of the Indian forms, until other characters in common can be found after examination of the animals.

To Albers' list, Adams added, it is difficult to say why, several other species, among them *ligulata*, *semirugata*, and *tranquebarica*, shells widely differing in their very globose form from the generic description. Semper does not follow Albers, but places many of the species under

Rhysota, on the character of the odontophore; these I have marked with an asterisk.

Albers refers the following species to Hemiplecta: *bulla, Pfr. (Rhysota, Albers) Luzon. fulvida, Pfr. Mindanao. biamensis, Mouss. Java. halata, Mouss. Java rufa. Less. New Ireland. canthotricha, Pfr. Guimares Is. and Negros. *setigera, Sow. Luzon. *qummata, Sow. Luzon. theodori, Phil. Mergui. bataviana, v. d. Busch. Java. centralis, Mouss. Java. cuvieriana, Lea Luzon. novæ-hiberniæ, Quoy. New Ireland. humphreysiana, Sea Singapur. - var. gemina, v. d. Busch. Java. ? labiata, Pfr. Landour. semigranosa, Sow. Phillippines. panayensis, Brod. .Panay, do. *semiglobosa, Pfr. Samar, do. Adams gives some others, three of which are Indian:blainvilliana, Lea. conoidalis. Adams and Reeve Mindoro. densa, Adams and Reeve Philippines. ? liquiata, Férus. Bengal. limaënsis. Mouss. *lurida*, Gould Feejee. rubricata, Gould Feejee. Madagascar? rufescens, Gratel. ? semirugata, Beck. Bengal. steursii, Shuttl. Amboins. ? tranquebaricha, Fabr. India. velutina, Sow. = xanthotricha, Pfr. Philippines.

Theobald has included a large number of Indian species in this subgenus, with forms so varied he subdivided it into 5 sections; he does not give the characters, but notes the typical species in each (vide Suppl. Index, Conch. Indica).

Nevill in his Hand-List makes it much more circumscribed and admits distincta, Pfr.

Saigon. neptunus, Pfr.

Cambodia.

*cymatium, Bs.		Penang.
sylvicola, W. Blf. MSS.		Naga Hills.
basileus, Bs.	16	Annamullys.
beddomei, Blf.	-	Travancore.
basilessa, Bs.		Annamullys.
? undosa, W. Blf.		Mandalay.
chenui, Pfr.		Ceylon.
†oxytes, Bs.		Khasi Hills.
†cycloplax, Bs.		Do.
P †castor, Theobald		Do.
? †pollux, Theobald		Do.
P †blanfordi, Theobald		Darjiling.
orobia, Bs.		Do.

Genus OXYTES, Pfeiffer.

Zeits. 1855, p. 188 [Without description.]

- 1. Nanina oxytes, Bs. (type.)
- 2. thyreus, Bs.

is a true Ariophanta.

3. avus, Pfr.?

sinistral and it is difficult to understand on what grounds it is placed here.

4. pallasiana, Pfr.?

This sub-genus would be the same as *Hemiplecta* (Sec. D) of Theobald (l. c. p. 22): who places therein:—

basilessa, Bs. Travancore. this should not be included. I do not recognize any resemblance even in form of the shell.

blanfordi, Theob.

castor, Theob.

Whasi.

var. a. cherraensis, W. Blf.

cycloplax, Bs.

pollux, Theob.

Darjiling.

Do.

Darjiling.

Darjiling.

Khasi.

Khasi.

HEMIPLECTA OBOBIA, Bs., Pl. XI, Figs. 1 and 1a. No locality given.

HELIX (HEMIPLECTA?) LIGULATA, Fér., Pl. XI, Fig. 8.

No locality given.

Vide Nevill's Hand-List (1878), p. 50, No. 284, as Xesta? his notes on the animal are taken from this drawing. Madras ranging to Bhagulpur and Patna. (H. H. G.-A.)

- * Placed in Rhysots by Stoliczka, J. A. S. B. 1878, p. 11.
- † Sub-genus Oxytes, Pfr. (see further on) forms a very recognizable group.

HELIX (OXYTES) OXYTES, Benson, Pl. XI, Fig. 2.

"No projection above the gland which is rather small: sole broadly margined, and with a double line," (W. T. B.) Nevill's Hand-List (1878) p. 47, No. 261.

I would call attention in this drawing to the close contiguity of the base of the eye-tentacles.

HELIX (OXYTES) POLLUX ?, Theobald, Pl. XI, Fig. 4.

- "Cherra Poonjee from Godwin-Austen" [Stoliczka].
- "Animal of a pale light yellowish ochre. Head rather darker, eve pedicels long and rather thick at the base. Extremity of foot and under part of it very pale, short, flat and rounded, the mucous gland has a very small lobe above it.
- "I found this shell very abundant on the limestone in the forest below Nongkulang in the West Khasi Hills, and it ranges westward to the Garo Hills following the band of the Nummulitic rocks. The very peculiar thick shape and drooping form of the tentacles is to be noted in the drawing, their bases adjacent as in H. oxytes." (H. H. G.-A.)
- "A small lobe above the mucous pore; margins of mantle not produced over the edge of the shell, sole of foot narrowly margined." (W. T. B.) Nevill's Hand-List, p. 48, No. 264.

EXPLANATION OF THE PLATES.

Plate X.

Fig. 1, 1a.	Helix	(Ariophanta)	interrupta, Bs.	
Fig. 2.			laidlayana, Bs.	
Fig. 3.			lævipes, Müller, var. trifasciata.	
Fig. 4.			intumescens, W. T. Blf.	
Plate XI.				

Fig. 1, 1a. Hemiplecta orobia, Benson.

Helix (Oxytes) oxytes, Benson. Fig. 2.

Helix (Hemiplecta?) ligulata, Fér. Fig. 8.

Helix (Oxytes) pollux ?, Theob. Fig. 4.

XVI.—New Species of Brackish-water Mollusks. By Geoffrey Nevill, C. M. Z. S.

(Received November 1st; -Read December 1880.)

Subfamily BYTHINIINÆ, Troschel [emend.].

Gebiss der Schnecken, I, 1857, as Group "Bythiniae"; emend. Stimpson, 1865, and Clessin, Malak. Blät. 1880, as subfamily of the Rissoidse.

STENOTHYRA WOODMASONIANA, n. sp.

T. parva, imperforata, ovato-acuta, solida, crassa, pallide viridula, polita, nitida, (sub lente) obsolete submalleata; spira aculeiformis, subconcava, producta, apice peracutissimo; anfr. 6, haud convexi, ultimus pertumidus, medio subangulatus, basi applanatus, antice ad aperturam abrupte et valide deflectus; apertura percontracta, perfecte rotundata, marginibus continuis, valide incrassatis.

Long. 31, diam. vix 2 mill.

HAB. Port Canning.

This interesting form is easily recognized by the very acute and concavely-excavated spire, the subangulate last whorl, flattened round the umbilical region; it is not spirally pitted, as in most species of the genus, but appears obsoletely malleated or indented under a powerful lens.

This is one of Mr. Wood-Mason's interesting discoveries from the still imperfectly explored brackish-water Sunderbunds (embouchure of the rivers Hooghly, &c.).

Type Indian Museum, Calcutta; also in coll. Dohrn, Beddome, Theobald, Blanford, and Hungerford.

STENOTHYBA HUNGERFORDIANA, n. sp.

T. parva, imperforata, ovato-elongata, solidiuscula, viridula, vix nitida, (sub lente) lineis impressis ac dense puncticulatis confertim cingulata; spira paululum elongata, ovato-convexa, apice obtuso, sutura profunda ac obsoleta marginata; anfr. 4, convexi, ultimus compresse ovuliformis, antice subapplanatus, valde descendens; apertura perpusilla, suboblique rotundato-ovata, superne leviter angulata, sulco profundiori ab anfractu ventrali separata, peristomate obtuso.

Long. 21, diam. 11 mill.

HAB. Andaman Islands.

This is one of the most distinct and interesting species of the genus as yet discovered: the few imperforate whorls, with markedly obtuse apex; the distinct, though minute, close punctulation; the unusually convex whorls, with the remarkable long, compressed, slightly flattened, and eggshaped last whorl are all good characters. The suture is very distinct and, on the last whorl, distinctly marginate below. The operculum is normal.

Type Indian Museum, Calcutta; also in coll. Dohrn, Warneford, Theobald, Blanford, and Hungerford.

STENOTHYRA BLANFORDIANA, n. sp.

T. minima, superficie rimata, subventricoso-ovata, vix solidiuscula, nitida, laevis, pallide cornea, subpellucida; spira subacuta, apice minuto, subobtuso; anfr. 4½, convexi, ultimus magnus, subsolutus, tumide-ventricosus, subbiangulatus, antice subapplanatus; apertura subovalis, paululum postice retrorsa, peristomate continuo, superne angulato. Operculum ovale, superne leviter acuminatum, vix crassiusculum, subtranslucidum, spirale, apice subcentrali, interne testaceo-costatum.

Long. $3\frac{1}{10}$, diam. $2\frac{1}{10}$ mill.

HAB. Chilka-lake (type); also Port Canning and Madras.

I am indebted to Mr. Wood-Mason for a careful examination of the operculum of this small form: "it is oval, subtransparent, spiral, of few whorls, with the apex almost central, on the inner side three ridges, one semicircular and two short ones with a slight S-curvature, for the attachment of the animal."

The species is somewhat variable, especially as regards size and the greater or less distinctness of the angulation of the last whorl. Specimens from Port Canning agree better with the above-described typical form than do those from Madras.

I have named this species in honour of its first discoverer, Mr. H. F. Blanford. It appears to be abundant at Port Canning, Chilka Lake, and Town of Madras; living with it there occurs another form, nearer St. minima, Sow. (but I think distinct), with more produced spire than St. blanfordiana, less tumid last whorl, without any trace of biangulation, with the aperture rounder, and not angled above; there is yet another still smaller decollate form from Port Canning, probably also a distinct species.

Type Indian Museum, Calcutta; also in coll. Hungerford, Theobald, Beddome, Blanford, and Dohrn.

Subfamily HYDROBIINÆ, Troschel [emend.].
Gebiss der Schnecken, I, 1857, as Group "Hydrobiae"; emend. Stimpson, 1865.

HYDROBIA (BELGRANDIA) MILIACEA, n. sp.

T. minuta, vix rimata, conico-elongatula, solida, parum nitida, albidoviridula, lævigata; spira paululum producta, apice minuto, acutiusculo;
anfr. 5, convexiusculi, ultimis duobus rapide accrescentibus, ultimo basi
subplanulato, ad aperturam gibbositate crassa circumscripto; apertura
ovato-rotundata, intus incrassata, peristoma continuum, valide incrassatum,
margine externo arcuato, basi sinuato, margine columellari subangulatim
contorto, subreflexo. Operculum sat profunde immersum, tenue, pellucidum, vitreum.

Long. vix 21, diam. 11 mill.

HAB. Port Canning.

Var. minor; long. 2, diam. 11 mill.

HAB. Port Canning.

Found in great abundance in brackish-water ponds, associated with Valvata (?) microscopica, Nev., new species of Bythinia, Martesia, Teredo (?), Pharella, Theora, Stenothyra blanfordiana, &c. From the last-named, the remarkable callosity behind the outer lip, besides many other characters above recorded, at once distinguishes it.

This interesting shell is the first extra European species described of the genus (?) Belgrandia, Bourg.

Type Indian Museum, Calcutta; also in coll. Beddome, Theobald, Hungerford, Joly, Dohrn, and Blanford.

Subfamily ASSIMINEINÆ, [emend.].

Group Lithoglyphi, Troschel, Gebiss der Schnecken, I, 1857 [pars].

Fam. Assiminidae, H. and A. Adams, Genera Moll. 1858.

Fam. Assimineidae, Clessin, 1880.

Section of sub-fam. Pomatiopsinae, Stoliczka, Gast. I, 1868.

Assiminea sinensis, n. sp.

T. imperforata, ovato-conica, solidula, nitida, subglabra, castaneo-fusca, linea impressa infra suturam subobsolete notata; spira producta, conica, apice subacuto; anfr. 7½, subplaniusculi, ultimus compressus, vix convexiusculus, carina nulla munitus; apertura parva, subverticalis, marginibus callo subobsolete junctis, margine externo tenui, margine columellari arcuato, incrassato, saturate castaneo-fusco, inferne subangulato.

Long. 5, diam. 3 mill.

HAB. Hongkong.

I am indebted for this, as for many other novelties, to Surgeon-Major R. Hungerford.

Type Indian Museum, Calcutta; also in coll. Hungerford.

Assiminea Peaseana, H. Nevill, MSS.

T. peranguste perforata, ovato-conica, notabiliter tenuis, glabra, nitida, vivide straminea, ad suturam fascia livida (plus minusve subobsolete) marginata; spira convexo-conica, producta, apice acuto; anfr. 7, convexiusculi, ultimus rotundatus, inferne convexus, circa perforationem haud carinatus; peristoma perregulariter rotundatum, ad basim haud angulatum; margo columellaris late dilatatus, subduplex, castaneo vivide tinctus; apertura subrotundata, marginibus callo subobsolete castaneo junctis.

Long. 52, diam. 32 mil.

HAB. Lake Negombo, Ceylon.

Named in manuscript by my brother, in honour of the late Harper Pease of Honolulu; it is a very distinct species, easily distinguished from Ass. subconica, Ass. marginata, &c., by its thin texture, peculiar coloration, absence of any trace of sculpture, rounded margins of the aperture, &c. Specimens of rather larger size than that of which the measurements are above recorded occasionally occur.

Type Indian Museum, Calcutta; also in coll. H. Nevill and H. Dohrn.

ASSIMINEA BIFASCIATA, n. sp.

T. imperforata, ovato-conica, solida, vix glabriuscula, subnitida, sordide viridula, fasciis binis fuscis et subobsoletis cincta; spira moderate producta, convexo-conica, apice subacuto; anfr. 6½, convexiusculi, ultimus tumide ventricosus, ad peripheriam subangulatus; apertura ampla, subverticalis, marginibus callo pervalido fusco-limbato junctis, margine columellari fere recto, valide incrassato, sordide fusco, inferne subrotundato.

Long. 51, diam. 31 mill.

HAB. Brackish-water lagoon, Port Natal.

A common species, quite distinct from the three forms described by Krauss.

Type Indian Museum, Calcutta.

Assiminea dohrniana, n. sp.

T. parva, solidiuscula, ovata, fusco-viridescens, anguste umbilicata, laevigata, sutura lineari, haud marginata; spira curta, apice perobtus; anfi: 4, rotundato-convexi ac tumidi, ultimus inflatus, subtus convexus, bari prope regionem umbilicalem subexcavate depressus; apertura subverticalis, ovato-pyriformis, dimidiam totius longitudinis aequans, intus pallide

viridescens; margo columellaris superne valide intortus, reflexus, inconspicus fulvo tinctus, inferne vix rotundatus.

Long. 3, diam. 21 mill.

HAB. Hongkong.

The short spire, with obtuse apex, the depression of the last whorl round the narrow umbilicus, the bent columella, and the thick somewhat eroded texture, of a greenish colour unusual in the genus, are the best characteristics of this small species, for which I am indebted to my friend Surgeon-Major R. Hungerford; I have named it after my esteemed correspondent Dr. Henry Dohrn of Stettin.

Type Indian Museum, Calcutta; also in coll. Dohrn and Hungerford.

Assiminea Woodmasoniana, n. sp.

T. imperforata (vel ad regionem umbilicalem mintissime perforata), carina parva ac subobsoleta circumscripta, lanceolata, conica, solidiuscula, nitida, subglabra, dilecte castanea, prope suturam pallide rubido fasciata ac linea impressa marginata; spira conico-elongata, anfractum ultimum fere aequans, apice perminuto, acutissimo; anfr. 7\frac{1}{2}, vix convexiusculi, regulariter crescentes, ultimus subcompressus, obscure subangulatus; apertura parva, subverticalis, ovata, marginibus callo tenui junctis, margine columellari pallide castaneo, paululum incrassato, subrecto, inferne subangulato.

Long. 4, diam. 21 mill.

HAB. Port Canning, near Calcutta.

I have named this pretty and very distinct species after my friend Mr. J. Wood-Mason, to whose very successful researches in the Sunderbunds the Museum is indebted for so many interesting mollusks, as I have already pointed out in my Catalogue, Fasc. E. p. 22, when describing the operculum of *Larina burmana*. The small, almost obsolete, keel round the very minute perforation (which is sometimes completely covered) is very characteristic.

Mr. Wood-Mason has favoured me with the following extract from his note-book on the animal of this species—" Eyes large, intensely black, situated on the upper side and near the extremity of the peduncle; animal transparent, above very slightly greyish, between the tentacles reddish, which are so transparent that the eye-spots can be seen very nearly as well from the under side."

Type Indian Museum, Calcutta; also in coll. Beddome, Hungerford, Blanford, Dohrn, Theobald, and Joly.

Assiminea Beddomeana, n. sp.

T. depresso-turbinata, quoad formam species generis Colloniæ quodammodo memorans, peculiariter obscure sed profunde umbilicata, depresso-conoidea, solida, crassiuscula, nitida, subglabra, ad basim (sub lente) striis incrementi subobsoletis munita, saturatissime fulvo-livida, infra suturam albo fasciata, fascia prope aperturam plus minusve evanescente; sutura vix distincta, linea obscure impressa et subobsoleta notata; spira obtuse depresso-conoidea, apice minutissimo; anfr. 5, ultimus subtus perglobose ventricosus, ad peripheriam obsolete subsubangulatus, infra subplanulatus, circa umbilicum callo lato pallide fusco et obscure albo-limbato munitus; apertura ampla, subrotundata, intus incrassata, marginibus callo albido prope aperturam valido ac distincto (interdum subobsoleto) junctis; columella pernotabiliter et valide incrassata, inferne abrupte retrorsa, triangulari-linguiformis, applanata ac excavate rugosa, superne in umbilicum abrupte desinens. Operculum tenue ac corneum; anfr. 3 (sub lente vis distinguendi) in umbonem subcentralem ac prominentem desinentes.

Alt. 3, diam. 31 mill.

HAB. Port Canning.

The most remarkable and abnormal species of the genus as yet described. The animal is that of a typical Assiminea, both the late Dr. Stoliczka and myself having examined numerous specimens. The Museum is indebted for its extensive series of this and the following species to Mr. Wood-Mason.

Type Indian Museum, Calcutta; also in coll. Dohrn, Hungerford, Blanford, Theobald, Joly, and Beddome.

Assiminea theobaldiana, n. sp.

T. parva, anguste umbilicata, ovato-conica, solidiuscula, vix nitida, corneo-fulvida, sub lente spiraliter minutissime confertimque sulcata, striis incrementi plus minusve obsolete decussata; spira conica, vix producta, apice acuto; anfr. 6½, convexi, supremi sublaeves, caeteri infra suturam distincte angulati, superne sublaeves, inferne spiraliter confertimque sulcati, oblique subgranulatim decussati, ultimus globose subrotundatus, in medio striis decussantibus plus minusve subobsoletis, prope umbilicum ditinctioribus, notatus; apertura sat ampla, subverticalis, marginibus callo nitido junctis, margine columellari supra leviter contorto, infra rotundato.

Long. 41, diam. 3 mill.

HAB. Port Canning.

In old specimens, the last two or three whorls have a pitted appearance, as in many species of Stenothyra; in younger ones, the two antepenultimate whorls have a beautiful granulose appearance under the lens. The oblique and decussating striae are always obsolete on the last whorl,

except near the umbilicus and in the interstices of the spiral sulcations; the narrow smooth ledge below the suture, on the last two or three whorls, formed by an abrupt cessation of the sculpture, is very peculiar and characteristic. I need scarcely say that I have named this remarkable species after my friend Mr. William Theobald of the Geological Survey of India.

Type Indian Museum, Calcutta; also in coll. Theobald, Hungerford, Beddome, Blanford, Dohrn, and Joly.

Assiminea microsculpta, n. sp.

T. parva, vix perforata, cylindrico-conica, solidiuscula, vix nitida, fulvo-cinerea, spiraliter distincte sulcata, striis longitudinalibus obliquis ac flexuosis decussata, apice acuto; anfr. 5\frac{1}{2}, gradato-cylindrici, supremi laeves, 2dus spiraliter sulcatus, 3tuis et 4tus insigne equaliterque decussati (quasi gemmulati), ultimus subbiangulatus, supra peripheriam angulatus, striis decussantibus paululum subobsoletis notatus, sculptura infra etanescente; apertura subverticalis, parva, marginibus callo indistincto junctis, margine columellari haud contorto, leviter rotundato.

Long. 23, diam. 13 mill.

HAB. Port Canning.

Type Indian Museum, Calcutta; also in coll. Dohrn, Joly, Hungerford, Theobald, Blanford, and Beddome.

It presents some resemblance to the preceding species in the sculpture, which in Ass. microsculpta, however, is much more strongly developed, the difference in young specimens being especially marked. The shape is quite different, the whorls being cylindrically-gradated, instead of convexly-swollen, &c.

Assiminea hungerfordiana, n. sp.

T. imperforata, ovato-conica, solida, nitida, glabra, polita, omnino laete castanea, sutura subindistincta; spira brevis, apice vix acuto; anfr. 6, subtumide convexiusculi, ultimus magnus, regulariter ovuliformis, infra suturam linea impressa subobsolete notatus; apertura verticalis, marginibus callo castaneo junctis, margine externo tenui, margine columellari incrassato, recto, paululum retrorso, ad basim subabrupte angulato.

Long. 4, diam. 21 mill.

HAB. Mouth of the Rangoon River.

I have much pleasure in naming this beautiful and very distinct species after its discoverer, Surgeon-Major R. Hungerford, who has lately been most successful in collecting and dredging Mollusca both at Hongkong and the Philippine Islands. The rich chocolate, or chesnut, colour of the

species is very characteristic; there is a slight tendency on the upper portions of the whorls to be of a darker and duller shade; the indistinct suture, short but produced spire, large and regularly egg-shaped last whorl, straight and slightly twisted columella, forming an angle at its base, are all well-marked characters. Under a very powerful lens, strize of growth are discernible, which become more developed behind the outer lip.

Type Indian Museum, Calcutta; also in coll. Hungerford.

Assiminea templeana, n. sp.

T. imperforata, ovato-conica, persolida, crassa, nitida, laevis, fusco-cornea, sutura distincta, haud marginata; spira conica breviter producta, apice acuto; anfr. 5\frac{1}{3}, convexiusculi, rapide crescentes, ultimus magnus, tumide ventricosus, ad peripheriam subangulatus, basi subapplanatus; apertura sat magna, marginibus callo acuto valido et albo junctis, margine externo regulariter convexo-rotundato, columellari subrotundato, duplice ac valide reflexo, regionem umbilicalem tegente, supra distincte transversimque unisulcato.

Long. 31, diam. 21 mill.

HAB. Nicobar Islands.

I have named this interesting small species after Lieutenant R. C. Temple, who has presented the Museum with many valuable shells from the Andamans, Ferozepore, and other places. It is eminently characterized by the remarkable callously-reflected, duplex columella, transversely notched or sulcated above.

XVII.—On some Experiments instituted to supply all the Lines terminating at the Calcutta Telegraph Office with Currents tapped from the Main-Current produced by a Dynamo-electric Machine.*

—By LOUIS SCHWENDLER, M. Inst. C. E.

Introduction.—On the 5th November 1879, I had the honour to read a short paper before this Society entitled,† "On a simple Method of using an insignificant Fraction of the Main-Current produced by a Dynamo-Electric Machine for Telegraphic Purposes."

In the present paper, I wish to record some more experiments on the same subject. As stated in my former paper, the dynamo-electric machine. during this first experiment, was placed at the store-yard, and was driven by the steam engine of that place. The telegraph current was conveyed to the Calcutta Telegraph Office by the store-yard line, which is about 4 miles in length. This first trial proved so successful that I ventured to propose a larger trial to supply all the lines entering the Calcutta Telegraph Office with signalling currents derived in this manner. But I could not then execute the new trial, as in the first place there were no proper driving arrangements at the store-yard (the erection of these would have cost money), and in the second place the dynamo-electric machine at my disposal had, by an accident, been temporarily spoiled. It was thought advisable, therefore, to postpone the suggested trial on a larger scale until the electric light arrangements at Howrah! should be completed, when an easy opportunity would offer itself for trying different dynamo-electric machines for the purpose. Besides, telegraph lines being already up between the Howrah Railway Station and the Calcutta Telegraph Office, no additional expense would need to be incurred.

New trial on a larger scale.—The preliminary trial was instituted on the 28th August, the final one on Sunday the 29th August 1880.

In the accompanying diagram, M is the dynamo-electric machine which produces the main current to be made use of for any required purpose; the negative pole of the dynamo-electric machine is connected

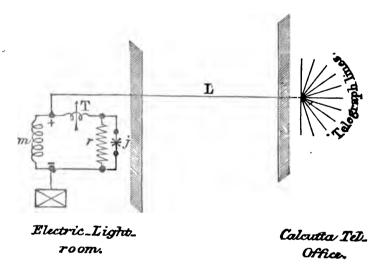
- The results given in this paper are taken from my report submitted to the Director General of Telegraphs in India on the 7th September 1880.
- † J. A. S. B., Vol. xlix, part ii, 1880, and Phil. Mag. No. 52. Suppl., December 1879.
- ‡ Mr. Bradford Leslie, Agent of the East Indian Railway Company. gave me permission to use the electric light arrangements at Howrah for the purpose. He also kindly permitted the use of the telegraph line connecting his office at Calcutta with the Railway Station at Howrah. This line was required to give orders during the experiment.

permanently to earth. The earth consists of 3 copper plates joined parallel and offering a parallel resistance of 1 67 ohms.

T is a tangent galvanometer for measuring the main current. In this case it was the tangent galvanometer employed in my electric light experiments in London in 1878. The resistance of the copper ring of this instrument is nil. Taking the late Mr. Brough's value for H, the horizontal component of the Earth's magnetic intensity at Calcutta to be H=0.37158 dynes, the formula for calculating the currents c from the deflections observed by this tangent galvanometer, is:—

c = 47330 tang a (milli-oersted).

r is a coil of iron wire (No. 24 i. w. g., 0.21" diameter) offering a resistance of 1.517 ohms at 85° F. The wire is coiled on a large wooden drum and serves as the constant resistance by which from time to time the efficiency of the dynamo-electric machines at Howrah can be gauged.



J represents an electric light, in this case produced by a large Serrinlamp.

In the following experiments, either r or J was used as the external resistance for closing the poles of the dynamo-electric machine to produce the *main* current; but *never* the *two* joined parallel.

L is the telegraph line from the dynamo-electric machine to the Calcutta Telegraph Office. This line is 1.75 miles in length and consists, from the electric light room to the Howrah Railway Station, of Hooper's india-rubber cable core, from the Howrah Station to the Kirk, of No. 6

^{*} The three single earths measured gave: 7.7, 3.1, and 6.9 B. A. U.

[†] The dimensions are 4' \times 2' and $\frac{1}{16}$ ".

i. w. g., and thence to the Calcutta Telegraph Office it is American compound wire of the same resistance as iron wire of No. 27 i. w. g.

At the Calcutta Telegraph Office, the battery wire* could at a moment's notice be connected with the key of each instrument, after throwing off the copper of the signalling battery in ordinary use. The telegraph lines terminating at the Calcutta Office were therefore all connected parallel to the battery wire, as is indicated in the foregoing diagram.

In order to enable me to directly compare the signalling current sent into the lines by batteries and by a dynamo-electric machine, each line is as tested for sent current at Calcutta, and for received current at the out-station.

Preliminary trial on 28th August 1880.—The line used for tapping the signalling current was No. 5, Calcutta to Allahabad, 577 miles in length, worked direct and having a real conduction resistance of about 3075 ohms. (taken from the August 1880 tests). The resistance of the relay at Allahabad equals 492 ohms.

1st Experiment.—This consisted in taking the sent current at Calcutta and the received current at Allahabad as produced by a battery of 60 minotti-cells connected up in series. This is the usual signalling battery during the monsoon.

2nd Experiment.—The main current in this experiment was produced by dynamo-electric machine A† through the resistance r. The resistance in circuit was not measured, but may be taken to be as follows:—

$$m = 0.652$$

$$r = 1.517$$
chms at 85° F.
$$l = 0.026$$

$$l = 0.026$$
Total,
$$2.195$$
ohms.

The main current gave a mean deflection of 37.9° ; $\frac{\text{max.}}{\text{min.}} = \frac{39}{36.2}$; mean speed of engine 60.3 revolutions per minute; $\frac{\text{max.}}{\text{min.}} = \frac{62}{58.5}$. The variation of the current corresponds with the variation of the speed.

3rd Experiment.—The main current in this experiment was produced by dynamo-electric machine E.‡ through the resistance r. This experi-

- The Telegraph line conveying the current produced by the dynamo-electric machine to the Telegraph Office may be called most appropriately the battery wire.
- + This is a Siemens' dynamo-electric machine called *medium sizs* (see my *precis* of report on the electric light experiments in London).
- ‡ This is a Siemens' medium machine altered according to my specification (See précis of report on the electric light experiments in London).

ment was made in order to see whether A or E machine would suit the circumstances best.

The resistance in circuit was not measured, but may be taken to be the same as given for A. The main current gave a mean deflection of 30.6° ; $\frac{\text{max.}}{\text{min.}} = \frac{33.7}{27.0}$; mean speed of engine = 59.9 revolutions per minute; $\frac{\text{max.}}{\text{min.}} = \frac{66}{54}$. The variation of the current corresponds with that of the speed.

The results of the preliminary trial are given in the following table:-

No. of Experiment.	Mode of pro- ducing the current.	Speed of engine per minute.		Mean speed per minute of dynamo-	Mean of main cur- rent in	Current in milli- oersteds.	
		Mean.	Max. Min.	electric machine.	milli- oersteds.	Sent at Calcutta.	Received at Allahabad
1	60 Minotti	•••		•••	9-8	9.8	5 •1
2	Dyn. el. machine A.	60∙37◆	62 ¹ 58·5 ¹	783	3 6,8 46	14.2	7:7
3	Dyn. el. machine E.	59 9 ⁶	$\frac{66^1}{54^1}$	641	27,991	9.4	66

The three experiments were made in the order given. Nos. 2 and 3 were made from 11 to 11.44 hours, during which time messages were sent. The insulation of the battery wire L was variable from 71,000 to 95,000 ohms absolute.

From Experiments 2 and 3, it will be seen that A machine produces a larger main current than E, which is due to the higher speed of A; further, that the sent current tapped from the main current of A is larger than the sent current tapped from that of E, just as it ought to be. In fact, if the line during the two experiments had kept constant, and if also r had kept constant (r increases considerably by heating), the proportion of the two main currents would have been the same as that of the two sent currents, and this is very nearly the case.† No. 3 Experiment with E machine gives about the same result as No. 1 Experiment with battery. To produce the

^{*} The small numbers in the form of exponents mean the number of observations made.

 $[\]uparrow \frac{A}{E}$ main currents = 1.32.

 $[\]frac{A}{E}$ sent currents = 1.55.

main current by A is therefore more advantageous than to produce it by E. Hence I employed A in the final trial.

The final trial on Sunday 29th August 1880.—The battery wire, before the trial began, was tested for insulation, and gave an absolute insulation greater than 1 Ω ohm. The main current, as already mentioned, was produced by dynamo-electric machine A; i. e., from 8.45 to 11.5 hours through the wire coil of resistance r, and from 11.5 to 11.32 hours through the arc of an electric lamp producing the light J. The light of the lamp was not measured, but may have been equal to about 6,000 standard candles.* The first line was connected to the battery wire at 8.45 hours; the last line at 10.53 hours. The whole trial was completed at 11.32 hours.

The change from r to lamp (J) was made in so short a time that none of the out-stations noticed it. Messages were sent and received in the usual regular style.

Mr. C. B. P. Gordon, the Superintendent of the Bengal Division, attended at the Signal Office.

At the beginning of the experiments, the resistances in circuit were measured.

Internal resistance of dynamo-electric
$$machine A$$
 $machine A$ m

After the experiments were over, these resistances were not measured again; however, on account of the very considerable heating by the strong main current, they must, we know, all have increased considerably.

When τ closed the poles of the dynamo-electric machine (8.45 to 11.5 hours) the mean speed of the engine was 60^{13} revolutions per minute; $\frac{\text{max}}{\text{min.}} = \frac{64'}{56'}$; while the mean deflection of the main-current was 37.87^{68} ; $\frac{\text{max}}{\text{min.}} = \frac{40.25^1}{35.0^1}$.

When the lamp was in circuit (from 11.5 to 11.32 hours), the mean speed of the engine was again 60^{13} ; $\frac{\text{max.}}{\text{min.}} = \frac{61}{59}$; while the mean deflection of the main-current was 44^{17} , $\frac{\text{max.}}{\text{min.}} = \frac{46^3}{42^1}$.

In the following table all the results are given:-

[•] When measured under 45° with the horizon.

Table shewing the Sent and Received Currents and other particulars.

1	2	3	4	5	6	7	8	
No. of Experiment.	Number and name of line and	Real conduction resistance of line in b. a. u.	Resistance of Relay at receiving station in b. a. u.	Currents in millioersteds.		Mode of pro-	Remarks.	
No. of E	length in miles.	Real cond sistance b. s. u.		Sent at Calcutta.	Received at out- station.	currents.		
1	No. 1 Jubbulpore 738	4,412	905	6·18 9·81 5·89	4·00 7·60 4·45	100 cells Dynel. m. A 100 cells	The several lines were connected to the battery wire	
11	No. 4 Jubbulpore 803	5,795	406	7·07 10·23 7·41	3·60 4·71 3·60	60 cells Dynel. m. A 60 cells	in the order given	
ш	No. 5 Allahabad 577	3,075	492	9·81 13·79 9·41	6.50 8·57 5·08	60 cells Dynel. m. A 60 cells	connected at 8:45 hours; the last line No. 3, Agra, at 10:53 hours.	
IV	No. 6 Sahibgunge 225	2,000	506	7·14 21·65 6·63	4·09 11·40 4·23	20 cells Dynel. m. A 20 cells	Before the actual experiments be- gan, i. c., before	
v	No. 7 Cuttack 400	2,800	953	6·63 11·00 6·63	3·38 6·00 3·00	85 cells Dynel. m. A 35 cells	the lines wer tested for securrents at Ca	
VI	No. 8 Coconada 800	7,000	3,711	4·00 8·15 4·00	3·60 7·20 2·01	119 cells Dynel. m. A 119 cells	cutta, and received currents at the out- stations, when the usual signalling	
VII	No. 9 Akyab 560	3,460	3,470	7·69 6·77 6·18	4·00 3·90 6·35	120 cells Dynel. m. A 120 cells	connected to the	
VIII	No. 11 Dhubri	•••	1,427	6·40 11·78 6·42	5·00 11·45 5·73	40 cells Dynel. m. A 40 cells	battery wire of the dynamo - electric machine, the sent currents at Cal-	
ıx	No. 10 Akyab 561	4,400	•••	15·39 15·39 17·43	3·10 3 90 3·30	80 cells Dynel. m. A 80 cells	cutta and the re- ceived currents at outstations were taken.	
x	No. 2 Agra 915	6,700	829	15·39 7·14 14·52	6·40 8·90 6·15	195 cells Dynel. m. A 195 cells		
XI	No. 3 Agra 850	5,800	1,959	13·54 13·38 9·41	3·25 3·10 4 14	100 cells Dynel. m. A 100 cells.		

After the dynamo-current was stopped at 11.32 hours, and the batteries had been connected up again, the sent currents at Calcutta and the received currents at outstations were again ascertained. Hence columns 5 and 6 contain 3 readings of sent and received currents for each line; first, with battery, secondly, with the dynamo-electric machine, and, thirdly, with the battery again. All the readings of the currents tapped from the main current of the dynamo-electric machine were taken between 8.45 and 10.53 hours, when the iron wire coil of resistance r was connected to the poles of the dynamo-electric machine. From 11.5 to 11.32 hours, when the lamp was substituted for r, no current readings at Calcutta and the outstations were taken.

The main current of the dynamo-electric machine, when r was in circuit, was 36,801 m. \ddot{o} ; when the lamp was in circuit, 45,706 m. \ddot{o} .* From this it does not follow, however, that the tapped currents in the second case were larger than in the first, because it would also depend on the resistance offered by the arc, which is not known. The resistance of the arc, as more current was produced with the same speed of the dynamo-electric machine, must naturally have been smaller than r=1.517 b. a. u. (iron wire coil), especially as there is an e. m. f. in the arc opposite to the e. m. f. of the dynamo-electric machine.

To produce 36,801 milli-oersteds through an external resistance of about 1.543 b. a. u., a total energy is consumed by the dynamo-electric machine of about 27,000 Ω ergs per second (representing about 3 h. p. per second).

Conclusions.—These experiments shew that it is perfectly possible and practicable to tap from the main current produced by a dynamo-electric machine all the signalling currents required at the Calcutta Telegraph Office. These currents were for the 11 lines connected up = 129·1 m. ö, if all keys were simultaneously and permanently sending. This represents only 0·35°/o of the main current (36,801 m. ö) with r in circuit, and ·28°/o of the main current (45,706 m. ö) with lamp in circuit. Further it will be clear that such a small variation of the main-current could not influence the regularity of any work done by that main-current.

Further, it will be seen that in all the experiments the sent currents tapped from the main current of the dynamo-electric machine were considerably larger than when produced by the large batteries at present in use. Experiments IX and X only form an exception. However, I think these exceptions are in both cases due to errors of observation, because the battery readings in Experiment IX do not all agree. The dynamo-current readings in No. X must be wrong, because in No. XI, for a total circuit resistance of 7759 units, the sent current is 13:38 m. ö,

[•] Calcutta by the formula: $\epsilon = 47330$ to (m. 0").

while in No. X, for a total circuit resistance of 65.29, the sent current is only 7.14. The error of observation is therefore obvious.

That with such strong received currents as are produced when the dynamo-electric machine is used, the lines should work well, is not to be wondered at. But it was also confirmed by the outstations having to adjust their relays much more unsensitively.

Supposing now that we had useful work day and night for the strong main current, and that on the whole the new method could be always depended upon, I believe these experiments have proved that the signalling currents required in telegraph stations could be had for nothing, and that the method would be quite practicable.

The useful work for the main current at night would most conveniently take the shape of an electric light to illuminate very efficiently the Signal The electric light, besides being more powerful, would possess the additional advantage of being produced by at least 50 times less heat than if the same light were obtained by combustion. This is no doubt a great advantage in a hot climate. During the daytime, I would use the main current for pulling punkhas, lifting messages, or, more generally, for working a pneumatic system of sending and receiving messages, &c., &c. If Calcutta had the good fortune to possess a colder climate, it might be suggested that the heat developed in the coil of wire should be used for warming rooms. It would then only be necessary to lead the wire along the walls, in a manner similar to that in which hot water pipes often are for heating rooms; the electric method being only far more economical. The heat given up by the wire, after dynamic equilibrium of the system has been established, is quite regular, and the method is obviously exceedingly clean and very convenient for domestic purposes. The wire attained its constant temperature of 93° C. after the current had acted for about half an hour, the air of the room having a temperature of 30° C.

The heat given out by the wire is by no means small. For instance, in our case, the average current working through a resistance r=1.548 b. a. u. was 36801 milli-oersteds. This represents work done at a rate of 20473 Ω ergs per second, and supposing the wire has obtained its constant temperature, this whole energy is developed into heat emitted by the wire into space at a rate of $\frac{20473}{42} = 488$ gramme-degree-centigrade

per second. This is equal to the heat produced by an ordinary German stove consuming 6ibs of coals per hour; supposing that the loss of heat when coals are burnt under a steam-boiler is four times as great as when they are burnt in a German stove. It appears, therefore, that the heat developed by the wire would be sufficient to keep a moderately sized and ordinarily ventilated room at a comfortable temperature even when situated in the highest latitudes.

XVIII.—On the Lepidopterous Genus Æmona, with the Description of a new Species.—By J. WOOD-MASON.

(With Part of Plate VI).

Several years ago, three plain pale-fulvous butterflies of moderate size were forwarded to the Indian Museum by Mr. S. E. Peal of Sibsagar, Assam. All three are of the male sex, and they agree so remarkably closely in size and colour as to have been taken for specimens of one and the same species. On examination, however, I find that, though superficially so similar to one another, they differ in structure and represent two distinct but closely-allied species, one of them being a male (hitherto undescribed) of **Emona Amathusia**, and the other two, males of an undescribed form belonging to the same genus. For the benefit of naturalists in India to whom the costly works in which they occur are inaccessible, I have extracted the original descriptions of the two described species.

The genus Æmona was established by W. C. Hewitson in 1868 for the reception of an insect from Northern India which he had previously described under the name of Olerome Amathusia. Hewitson appears to have had some misgivings as to the propriety of this step, but, as will be seen from the following amended diagnosis, the genus is at least as distinct from Clerome as this is from Thaumantis, or as Zeuxidia from Amathusia.

Genus ÆMONA, Hewitson.

Head small. Antennæ rather short. Anterior wing acutely pointed and produced, or sharply angulated, at the apex; its inner margin straight in both sexes, not being lobed at the base in the male as it is in Olerome and less distinctly in Thaumantis; the costal vein reaching to the end of the fifth seventh of the length of the anterior margin; the subcostal 4-branched, the first branch given off just before the end of the cell, and, after running free for nearly the same distance beyond that point as it originates before it, completely coalescing with the costal, but again becoming free just before this last-named vein turns off to the anterior margin, the three remaining branches free. Posterior wing more elongated than, and not quite so rounded as, in Clerome; without the pencil of erectile setse which, in the males of Clerome and Thaumantis, arises from the wing-membrane of the discoidal cell close to the subcostal vein and lies obliquely across a patch of elevated and crowded scales on the other side of this vein, the male scent-fans, if such are really present in this genus, being situated in a different part of the wing, viz., in the anal region,

where a line of setæ running along the anterior side of the submedian vein ends in a curled whisp which, when at rest, lies in a slight groove or fold of the wing-membrane.

Plain and delicate butterflies of a pale fulvous colour inconspicuously or obsoletely occllated on the underside.

In the form of the hind-wings and in the position of the male scentfans *Æmona* agrees with *Xanthotænia*, and in its pointed fore-wings with *Zeuxidia*, *Enispe*, and *Discophora*, but it differs from these and from all the other Indian genera of *Morphinæ* in the relations of the costal and subcostal veins to one another, and in other respects.

(a.) Fore-wing produced and pointed at apex with its outer margin concave-sinuous.

1. ÆMONA AMATHUSIA. Pl. VI, Figs. 3, 4, 8.

Clerome Amathusia, Hewitson, Trans. Entom. Soc. Lond. ser. 3, vol. iv, 1867, p. 566, Q.

Emona Amathusia, Id., Exot. Butt. vol. iv, 1868, Zoux. et Em. pl. i, fig. 3-4, Q.

- 9. "UPPERSIDE rufous-brown, the bands of the underside seen through. Anterior wing crossed beyond the middle by a band of orange-yellow: the apex dark brown. Posterior wing with some arcuste spots near the apex.
 - "Underside rufous, tinted with darker colour. Both wings crossed at the middle by a common rufous-brown band: both with a band of minute rufous ocelli some of which are pupilled with white: both with a submarginal band rufous. Anterior wing with a pale rufous band near the base and a spot of the same colour at the end of the cell. Posterior wing with a dark rufous band near the base.
 - " Expanse 3 inches
 - "HAB. Northern India."

The female is only known to me from Hewitson's description and figures.

strigge or bands of the underside showing through. Anterior wing darker at the base and at the tip, between which darker parts the colour is very pale yellowish-fulvous. Posterior wing of the same shade as the base of the anterior one to within a short distance of the margin, whence it is paler, and with an indistinct submarginal series of arcuate marks extending from the apical to the anal angle. Underside uniform pale fulvous; the strigge as in the female; the ocelli (one, the second and largest, perfect, the remaining five rudimentary) of the posterior wing also as in the female, but in the anterior wing only the one between the first and second median veinlet and faint traces of that between the first median veinlet and the submedian vein are present; the thin submarginal brown line more obviously engrailed than in the female.

Length of anterior wing 1.4; whence expanse = 2.9 inches. Hab. Naga Hills (S. E. Peal). A single specimen.

2. ÆMONA LENA.

- E. lona, Atkinson, Proc. Zool. Soc. Lond. 1871, p. 215, pl. xii, fig. 1, & .
- dark brown band, interrupted by the nervures from before the apex to near the posterior margin at two-thirds of its length from the base, beyond the band darker, with a slightly marked and incomplete submarginal line, before which is a series of five pale lanceolate blotches between the nervures directed towards the outer margin. All the nervures tinged with yellow and more or less dark-bordered. Hind wing: anterior portion from base to outer margin pale, posterior portion bright yellow, crossed by a submarginal series of three dark-bordered white blotches, and a fourth fainter blotch between the nervures, forming a short interrupted band from near the apex to the second median nervure. The submedian nervure fringed from its origin to near its extremity with long yellowish hairs, longest and most conspicuous towards its extremity.
- "Underside. Both wings crossed by a dark ferruginous band with sharply defined outer edge from the costa of the fore-wing near the apex to near the extremity of the submedian nervure of the hind-wing, and having a faintly traced submarginal line, before which is a series of blind white-centred ocelli. The cell of the fore-wing crossed near its middle by a curved ferruginous band. Hind-wing crossed by a ferruginous band near the base.
 - "Antennæ ferruginous; palpi and legs tawny yellow.
 - "Expanse of wings 31 inches.
- "Hab. Yunan." Moolai, Upper Tennasserim 3,000—6,000 ft. (Moore).
 Atkinson does not give the sex of the specimen described and figured by him, but, as the two specimens in the Indian Museum obtained at the same time are males and agree perfectly in size and markings with his figure, he may be presumed to have described a male. In a specimen of the male recently received from the upper Thoungyeen forests, British Burmah, by Captain G. F. L. Marshall, the three white spots on the anterior half of the hind-wing are larger, forming a band divided by the veins.
 - (B.) Fore-wing sharply angulated at the apex with its outer margin arched.
 - 3. ÆMONA PEALII. Pl. VI, Figs. 5, 6, &.
 - E. Pealii, Wood-Mason, Proc. Asiatic Soc. Bengal, July 1880, p. 123.
- 8. Closely allied to Æm. Anathusia. UPPERSIDE coloured and marked in the same manner, but with the occili as well as the strigge of

the underside showing through. Anterior wing with the apex angulated but not produced, the outer margin arched instead of concave-sinuous, and the inner angle not so broadly rounded. Posterior wing darker-coloured and also paling towards the outer margin, but with the submarginal series of arcuate marks smaller and less distinct. UNDERSIDE coloured and marked in much the same manner, but with more perfectly formed and more numerous ocelli; the anterior wing having three (the first between the submedian vein and the first median veinlet, the second the largest and best defined) perfect ocelli and two or three rudimentary ones following them, and the posterior wing, one rudimentary (close to the submedian vein) and six (the first in the same interspace with the rudimentary one, and the second the largest of all) perfect ones; each ocellus dark brown encircled by a very fine line of the colour of the strigs and pupilled with iridescent silvery-white; the thin submarginal brown line rather more deeply engrailed.

Length of anterior wing 1.35; whence expanse = 2.8 inches. HAB. Sibsagar, Assam (S. E. Peal). Two specimens.

XIX.—Description of a new Papilio from the Andaman Islands.—
By J. WOOD-MASON.

(With Part of Plate VI.)

Papilio Læstrygonum. Pl. VI. Figs. 1, 2, &.

- P. Lasstrygonum, Wood-Mason, Proc. Asiat. Soc. Bengal, June, 1880, p. 102.
- 3. Wings above cretaceous-white, the anterior ones black at the insertion, scarcely tinged with greenish at the base, with five black bands commencing at the anterior margin and cutting the cell, the first basal, extending to the inner margin, the second rather broader, also extending to the inner margin, and emitting a short conical process at the origin of the first median veinlet, the third scarcely broader, extending to the median vein, the fourth narrower, triangular, reaching or all but reaching the median vein, the fifth much the broadest of all, triangular, divided anteriorly into two forks by a curved narrow decreasing and interrupted band of the ground-colour running from the costal vein to the third median veinlet, extending to the inner margin, separated from the black outer marginal band by a band of the ground-colour divided by the black veins and very slightly if at all narrowing from the anterior margin up to the second median veinlet, whence it gradually decreases in width and distinctness to the inner

angle; all these black bands connected at the anterior margin, and the first, second, and fifth of them at the inner margin also, by a very narrow edging of black.

Posterior wings with two black bands commencing and connected at the anterior margin and coinciding with bands of the underside, one basal, extending to the end of the first half of the first median veinlet, and the other discal, extending a short distance into the space between the 2nd and Brd median veinlets; with a small black spot near the end of the cell scarcely distinct from the discal band; with four discal spots immediately beyond the cell running nearly parallel with the band, the first and largest transversly elongated and coinciding with a spot on the underside, the rest smaller than the corresponding ones on the underside, which latter are consequently seen through the wing-membrane beyond the margins of the former; with a black spot succeeded by one of luteous at the anal angle; with a marginal and submarginal series of black lunules coalescent in the anterior third but more distinct in the posterior two-thirds of the wing, where the two series are more or less separated from one another by ashy-grey scales continuous with the ashy patch occupying the outer third of the wing and extending also along so as to obscure the ultra-cellular part of the basal black band; with the discal band and spots more or less irrorated and obscured with ashy-grey scales so that the disk of the wing appears mottled with black and grey; and with the black tails, as also the incisures, margined with cretaceous-white.

Wings below pure white, anterior ones marked as above, with the ground-colour at the base and between the black bands as far as the median vein and its second branch yellowish; with the band of ground-colour separating the fifth black band from the black outer border distinct, and not decreasing but on the contrary rather increasing in breadth, to the inner angle; and with the curved line dividing the fifth black band into two forks more distinct and less discontinuous.

Posterior wings, from the base up to the median vein and the discal black band, yellowish, with three black bands, one narrow running from the insertion along the inner margin close to the abdominal fold, and two broader commencing and connected at the anterior margin and cutting the cell, one of these latter basal, extending nearly to the end of the basal half of the first median veinlet, and the other discal, some distance into the space between the 2nd and 3rd median veinlets, the two first of the three bands connected together at their outer extremities and with two largish coalescent black spots in the anal region; with a small black spot near the extremity of the cell, and six of the same colour immediately beyond it disposed in a line which runs straight from the costal vein as far as the cell, but then curves

abruptly inwards, the first of these spots transversely elongated, extending from vein to vein, and connected with the second, which is roundish and itself connected with the discal band, the third oval, about one-third the size of the second, and touching the discocellular veinlet, the fourth twice the size of the third, in contact with the median vein and its two last branches, the fifth rather smaller than the third, the sixth crescentic and connected with the two above-mentioned large spots in the anal region; with six large diffused luteous blotches externally margined with black, and increasing in size and depth of colour from the anterior to the inner margin; with the ground-colour between these blotches and the discal black spots pure white; with an increasing series of six marginal lunules, between which and the wavy black margins of the luteous blotches the ground-colour is white in the anterior and grey or greyish-white in the posterior portion of the wings; and with the incisures and the tails margined with lutescent.

Head black with two white frontal bands; collar with a luteous spot on each side; thorax above jet-black ornamented at the sides with long grey setæ, below cretaceous-white; abdomen cretaceous-white with a tapering dorsal black band and two lateral fuscous ones.

Length of anterior wing 1.7; whence expanse = 3.5 inches.

HAB. South Andaman. Two specimens, both males, obtained by Mr. A. R. de Roepstorff.

To mark its close relationship to *P. Antiphates*, I have called the species *P. Laestrygonum* after the mythical people over whom Antiphates is supposed to have reigned. It differs from its nearest ally in having the upperside much blacker (the bands of the forewing being broader, and the first, second, and fifth of them with the marginal one extending to the inner margin where they are all connected together by a very narrow black edging, and the disk of the hindwing mottled as it were by black and grey) and a much greater extent of grey and more highly developed marginal and submarginal lunules on the hind-wing; in the abdomen being dorsally banded with black and the thorax ornamented with grey setse, &c.

P. S.—On the 17th Nov., after the above had been sent to press, the fourth part of M. Oberthür's work entitled 'E'tudes d' Entomologie' was received in the Indian Museum, and in it I find the same species described and figured under the name of P. Epaminondas; but, as it seems to me not quite certain whether this name was actually published before mine, I have left it to M. Oberthür to effect the change of names that will become necessary if the fourth part of his work should really have been issued to the public before June, 1880.

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XX.—Contributions to Indian Malacology, No. XII. Descriptions of new Land and Freshwater Shells from Southern and Western India, Burmah, the Andaman Islands, &c.—By W. T. Blanford, F. R. S.

(Received Nov. 20th; -Read December 1st, 1880.)

(With Plates II and III.)

More than ten years have elapsed since the last number of these 'Contributions' was published.* The time that I have been able to devote to Zoology in the interim has been occupied with other subjects, and several forms of Indian land-shells that have been in my possession for years have remained undescribed. Of a number of these, I had drawings made some years ago, and several of the figures that accompany the present paper were included in a plate prepared for publication as long since as 1871, but never lithographed.

These ten years have seen so many additions to the literature of Indian land and freshwater shells that the whole aspect of the study has been changed. Foremost in importance are the late Dr. Stoliczka's papers in this Journal† on the anatomy of several forms of *Helicidæ*. The untimely death of Dr. Stoliczka, one of the most able and energetic workers who ever devoted his attention to Indian Mollusca, has prevented the design he had formed of publishing a monograph of Indian Cyclostomacea

[•] J. A. S. B., 1870, xxxix, pt. 2, pp. 9-25.

[†] Vol. xl, 1871, pt. 2, pp. 143, 217, and xlii, 1878, pt. 2, p. 11.

from being carried out. A considerable number of drawings had been made for the work, in the preparation of which I had agreed to join, but of these drawings the most important, those representing the anatomy of the various genera, are not, I fear, sufficiently clear for publication in their present form, and notes to explain them are wanting. Some of the most useful of Dr. Stoliczka's anatomical studies, those on the structure of various *Helicida*, have, however, I am much pleased to say, been continued by Colonel Godwin-Austen with important results.

The same decade has seen the completion of a series of illustrations, many of them well executed, of Indian land and freshwater shells, the 'Conchologia Indica' of Hanley and Theobald. The work is mainly due to Mr. Hanley, upon whom the whole of the editorial labour has fallen, Mr. Theobald having been absent in India during the publication. Whilst it is impossible to avoid regretting that more complete illustrations of most of the species have not been given, and that some additional details have not been furnished in the accompanying letterpress,* it is unquestionable that the plates are a valuable contribution to the knowledge of Indian Mollusca.

Two other rather important works on Indian land and freshwater shells have been issued since the completion of the 'Conchologia Indica.' One of these is Mr. Theobald's 'Catalogue of the Land and Freshwater Shells of British India'†, the other, Mr. G. Nevill's 'Hand-list of the Mollusca in the Indian Museum, Calcutta', Part I.‡ The value and accuracy of the first-named work are unfortunately seriously diminished by the great number of misprints, errors, and omissions, partly due to the author's absence from Calcutta when the list was printed. Five quarto pages in small print are filled with additions and corrections; this list, however, is not only far from being exhaustive, but contains some additions to the catalogue of mistakes.§ The 'Notes on the 'Conchologia Indica,' 'p. 50, contain some important corrections of localities cited in that work.

- One most important omission might yet perhaps be rectified. A large number of the figures are from types, or from typical examples, and, in such cases, if the figure is correct, there can be no question as to the determination of the species. But many of the figures are from shells that, although doubtless in general correctly identified, are not the specimens originally described, nor even in all cases from the same locality. A list of the figures taken from actual types would be useful in cases of disputed identity.
 - + Calcutta, 1876, published by Thacker, Spink and Co.
 - 1 Calcutta, 1878.
- § To justify my criticism of my friend Mr. Theobald's 'Catalogue', I will give two instances of the errors it contains. At p. 15, the genus Omphalotropis (with two species O. distermina, B. and O. aurantiaca, Desh., is placed in the family Rissoidae, subfamily Pomatiopsinas. At p. 43, the same genus Omphalotropis (with but one species O. distermina, B.) is repeated as a member of the family Helicinidae, subfamily Hydroceninas.

Mr. Nevill's 'Hand-list of the Mollusca in the Indian Museum' is especially important for the large number of localities given. In some few instances (as in all such lists), some names will be found to require revision, and one or two instances will be given in the present paper. I have already expressed my reasons for dissenting in some respects from the classification adopted. But it would be unfair to convey the impression that mistakes are numerous, indeed, considering that Mr. Nevill had not the advantage of correcting the proof-sheets himself, errors, so far as I have examined the work critically, appear singularly few in number, and in many points the classification adopted for the *Helicida* of India is a considerable improvement on anything that had previously been published. At the same time, there is, I believe, very much more to be done before these puzzling shells are properly arranged.

In the various works just mentioned, some species are quoted by names given by me, at various times, in manuscript, but never published. Of these forms I have given descriptions in the following pages. In several instances, the shells have been figured in the 'Conchologia Indica.' One form thus figured (Spiraculum mastersi), I have already described in this Journal (vol. xlvi, 1877, pt. 2, p. 313), and two other species (Cremnoconchus fairbanki and Corbicula iravadica) represented in the same work require explanation. To facilitate reference, this is given below under the name of each shell.

This mistake is not corrected in the long list of 'Addenda et Corrigenda.' To shew how grave the error is, it is only necessary to mention that the Rissoidae are as distinct from the Helicinidae in organization as are the Littorinidae from the Neritidae, and that Omphalotropis has been clearly proved to belong to neither, but to the Cyclostomidae (See Ann. Mag. & Nat. Hist. May, 1865, ser. 4, vol. iii, p. 841). Moreover, the Indian locality of Omphalotropis aurantiaes had been shewn to be erroneous by Hanley in the 'Conchologia Indica.' The error was long since suggested by Benson (Ann. & Mag. Nat. Hist. Sept. 1851, ser. 2, vol. viii, p. 194).

The other error that I shall notice occurs in the 'Addenda et Corrigenda' and runs thus:—"Page 15, add Acmella hydria, Godwin-Austen. North East Bengal." The reference quoted is 'Minutes of the Trustees, Imperial Museum,' Calcutta, vol. vii, p. 162. Now the minutes quoted are not published, but merely printed for record, and the notices contained in them of additions to the Museum are mere lists of the names that happen to be attached to specimens, inserted without any attempt at verification. Precisely the same is the case in the 'Register' at the British Museum. Had Mr. Theobald looked at the specimens, or had he made any enquiry about the shell, he would, I think, have easily learned that no such name as 'Acmella hydria' was ever published, and that the shell so-called, was, if I am not mistaken, Tricula montana.

[•] Proc. A. S. B, 1879, p. 55.

⁺ For instance, I cannot help doubting whether any of the numerous forms referred by Mr. Nevill to Microcystis are really congeneric with H. ornatella the type of the genus.

Of the remaining species here described, the majority have been collected by Colonel Beddome in the hill-tracts of Southern India. Some of these were sent to me as long as 9 or 10 years ago, others have been received more recently. I feel that I owe many apologies to Col. Beddome and to the other gentlemen, Dr. Anderson, Col. Evezard, and Col. Godwin-Austen, who have kindly entrusted me with the description of their discoveries, for leaving these so long unnoticed.

The plates accompanying the present paper are unfortunately deficient in many respects. Several species are not represented, and some of the representations given are far from being good. The original drawings were, in all cases, excellent, but some of them may, after being kept for several years, have become indistinct in parts, and as the lithographer had not the shells for comparison, he may have misunderstood the details. The larger shells represented in plate iii. are fairly well delineated, but several of the small forms in plate ii. are more or less faulty.

The importance of a careful study of the anatomy in the different forms of Helicidæ has already been mentioned. Very much remains to be done before anything like a correct classification of the family can be practicable. That all the forms referred to Nanina (a name which has no claim to recognition) must be separated from Helix is clear enough; the animals belong to different subfamilies at least, but it is by no means certain how many real generic groups there are in the so-called Nanina. I suspect that Macrochlamys, very possibly with some of the forms referred by Stoliczka to Rotula,* will have to be separated generically from another group comprising the sections known as Hemiplecta and Ariophanta, which are very closely allied to each other, and which are probably congeneric with Xesta and several other forms. For the present, I have simply referred the species described to the sections to which they appear to belong, as Stoliczka did, but I am by no means prepared to follow him in accepting such sections as of generic rank. The difficulty is to determine what generic name or names should be adopted. Nanina is utterly bad; it offends every law; the name had been used previously by Risso; the type is the same as that of Benson's genus Macrochlamys; and the term is objectionable on account of its signification. All this has been pointed out by Martens,1 but still he and others employ the name because it has crept into use. Now, in such difficult matters as these generic terms, unless rules are strictly attended to, utter confusion must result, and undoubtedly it has resulted. When, however, a search is made for a better founded term then Nanina, endless difficulties are encountered. The ear-

[•] These appear, however, to deserve distinction from true Rotula, see after.

[†] See Stoliczka, J. A. S. B., 1871, xl, pt. 2, p. 47.

¹ Albers Heliceen, 2te Ausgabe, p. 46, where the synonymy is fully discussed.

liest name is Helicarion of Ferussac (1822), but it is far from clear that this is not generically distinct from both Macrochlamys and Ariophanta. The next term is Stenopus of Guilding (1828), applied to a West Indian shell. This genus is evidently closely allied to the so-called Nanina: the only distinction pointed out by H. and A. Adams* is that the sole in Stenopus is narrower than the sides of the foot, but this does not hold good universally.† A better difference is probably the position of the genital orifice, which appears to be, in Stenopus, some distance behind the head, as in Zonites, and not just behind the right tentacle, as in 'Nanina.' After Stenopus follow Macrochlamys of Benson (1832) and Ariophanta of Desmoulins (1833), the first founded on H. indica (Benson nec. Pfr.), believed by many authors to be the same as H. vitrinoides, the second founded on H. lævipes. The name Nanina was given in 1834. My impression is that Helicarion, Macrochlamys, and Ariophanta will have to be accepted as genera, Nanina being merely a synonym of Macrochlamys.

I must apologize for taking up space by repeating what has been often written before, but it is only right to explain why I now describe as *Hemi-plecta*, *Euplecta*, &c. shells allied to others formerly in these 'Contributions' called *Nanina*.

1. ARIOPHANTA IMMERITA. Plate III, Fig. 4, 4a.

Nanina (Ariophanta) immerita, W. Blanf., J. A. S. B., 1870, xxxix. pt. 2, p. 17.

Helix immerita, Pfr., Mon. Hel. vii. p. 128; Hanley & Theobald, Conch. Ind. pl. cl, fig. 7.

This shell was originally described from an immature specimen, and the same was figured in the 'Conchologia Indica.' Subsequently, Col. Beddome obtained an adult shell from the same locality, South Canara. Of this example a figure is now given. The species only differs in sculpture from A. interrupta, which is found in various parts of Bengal‡ and Orissa, and has been procured by Col. Beddome as far south as the Golcondah range of hills in Vizagapatam. The two forms replace each other in the eastern and western parts of the Indian peninsula, precisely as do their allies A. lavipes and A. laidlayana.

Oxytes sylvicola, sp. nov.

Testa perforata, depressa, carinata, solidula, olcoso-micans, epidermide orassiuscula obtecta fulva vel luteo-fusca, striis obliquis incrementi

- Gen. Rec. Mollusca, ii, p. 221.
- † E. g. in Macrochiamys, some forms of which at least have the central tract narrower than the lateral.
- ‡ Amongst the localities given in the 'Hand-list of Mollusca in the Indian Museum,' part i. p. 19, is Singhar. This cannot be Sinhgarh near Poona, in the Deccan.

atque lineis impressis minutis spiralibus subdistantibus superne decussata (nucleo sublavigata), subtus lavior sed distincte decussato-striata. Spira parum elevata depresso-conoidea, fere convexa, apice obtuso, sutură lineari, antice vix impressă. Anfr. $5\frac{1}{3}$, sensim accrescentes, primi planulati, ultimi convexiusculi, ultimus haud descendens, subtus convexus, modice inflatus, sed infra carinam, nisi juxta aperturam, leviter compressus. Apertura obliqua, angulata-lunaris, intus livido-albida; peristoma acutum, intus subincrassato-labiatum, marginibus callo tenui junctis, columellari curvato, breviter reflexo. Diam. maj. 32, min. 29, axis 17 mm. Apert. $16\frac{1}{3}$ mm. lata, $13\frac{1}{3}$ oblique alta.

HAB. In montibus 'Burail Range' dictis, ad alt. 3000-4000 pedum, in provincia 'North Cachar' Bengaliæ orientalis (H. H. Godwin-Austen).

Shell perforate, depressed, carinate, not very thin, having a greasy lustre, and a thick epidermis, tawny or yellowish brown, marked with oblique raised strize of growth decussated by fine subdistant spiral impressed lines above (the nucleus almost smooth), and with fainter radiating strize and concentric impressed lines below. Spire but little raised, almost convex, depressedly conoid, apex obtuse, suture linear at first, but slightly impressed near the mouth. Whorls 5½, gradually increasing, the inner nearly flat above, the outer slightly convex; the last not descending, convex and moderately swollen below, but slightly compressed just below the keel, except near the mouth. Aperture oblique, angulately lunate, a little broader than high, pale livid within. Peristome sharp, with a slightly thickened lip inside, the margins joined by a thin callus, columellar margin curved, reflected for a short distance at the perforation. Major diameter 1.26 inches, minor 1.14, axis 0.69, breadth of aperture 0.65, height (measured obliquely) 0.53.

There is a very remarkable resemblance between this shell and that described by me as Nanina koondaensis (J. A. S. B., 1870, xxxix, pt. 2, p. 16, pl. iii, fig. 12), yet I am by no means sure that both belong to the same section or subgeneric group. N. koondaensis is an ally of N. indica (Pfr.) and N. shiplayi, shells doubtless nearly allied to Hemiplecta, and very possibly belonging to that subgenus, but hitherto referred to Rotula, or to other sections. O. sylvicola is larger, more solid, and covered with a distinct epidermis, and the sculpture is less granulate above, the spiral impressed lines being more distant.

I have seen but one specimen of O. sylvicals, for which I am indebted to Col. Godwin-Austen. It is figured here. Other specimens, I learn, are larger.

Stoliczka, J. A. S. B., 1871, xl, pt. 2, 231.

8. HEMIPLECTA TINOSTOMA, sp. nov., Plate III, Fig. 1.

Testa anguste umbilicata, convexo-depressa, confertim striis spiralibus minutis lineisque incrementi decussata; fulva, linea pallida angusta supra peripheriam, altera fusca infra, cincta; subtus pallidior, lævior, nitidula. Spira convexa, apice obtuso, sutura primum lineari, antice impressa. Anfr. 5, planiusculi, sensim accrescentes; ultimus convexior, antice latior subascendens, ad peripheriam angulatus, subtus convexus, aperturam versus planulatus. Apertura obliqua, multo latior quam alta, lunato-oblonga, intus albescens, fascia peripherali albida conspicua; peristomatis marginibus subparallelis, callo tenui junctis, basali albo, recto, crassiusculo, longe obliquo, ad umbilicum subreflexo, supero arcuato, leviter inflexo. Diam. maj. 50, min. 89, axis 21 mm.; apert. 28 mm. lata, 18 oblique alta.

HAB. In montibus 'Tinnevelly Ghats' dictis Indiæ meridionalis, ad latus orientale provinciæ Travancore (H. Beddome).

Shell narrowly umbilicate, convexly depressed, closely decussated with fine spiral strize and lines of growth, smoother beneath, yellowish brown above, paler below, surrounded by a narrow pale line just above the periphery and a dark line below. Spire convex, apex obtuse; suture at first flat, becoming impressed towards the mouth. Whorls 5, the first nearly flat; the last convex above, becoming more so towards the aperture, where it is rather broader and rises a little; below, the shell is convex, but flattened near the mouth, and the greater breadth of the last whorl near the aperture is more conspicuous than above. Aperture oblique, much wider than high, brownish livid, with a whitish enamel within, the pale peripheral band being conspicuous; peristome slightly sinuate, the upper and lower margins nearly parallel, the former slightly inflexed, the latter oblique, straight, white, and somewhat thicker than the other margins. Major diameter 2 inches, minor 1.55, axis 0.85; breadth of aperture 1.1, height (measured obliquely) 0.72.

This shell somewhat resembles *H. basilessa* and *H. beddomei*, but differs from both in the peculiar form of the aperture and the great flattening of the last whorl beneath. The fine, decussated, almost granulate sculpture of the present species, and the less rapid increase of the last whorls would serve to distinguish it from either of the forms named, even if the peculiar shape of the aperture proved to be an individual peculiarity—not a very probable supposition, as there is a faint approach to the same change of form in the last whorl in *H. basilessa*.

But a single specimen has been procured by Col. H. Beddome, and entrusted to me for description. This shell was obtained on the Tinnevelly Ghats, between Tinnevelly and Travancore, at a spot east of Papanassam, and at an elevation of 5000 feet.

4. HEMIPLECTA ENISA, sp. nov., Plate III, Fig. 2, 2a.

Testa anguste umbilicata, depressa, subcarinata, fulvo-castanea, subtus pallidior; fascid exigud peripherali albidd circumdata, confertim striis incrementi lineisque minutis spiralibus subgranulatim decussata, circa umbilicum lævior. Spira depresso-convexa, apice obtuso, suturd primum lineari, antice impressd. Anfr. 4½, planiusculi, sensim accrescentes: ultimus superne magis convexus, ad peripheriam subangulatus, antice latior, subtus convexus, juxta aperturam paululo compressus. Apertura obliqua, latior quam alta, lunato-oblonga, supra peripheriam subangulata, intus pallide livida, fascid peripherali albescente conspicud; peristomatis marginibus subparallelis, callo tenui granulato junctis, supero externoque arcuatis, haud inflexis vel incrassatis, basali albo, recto, obtuso, longe obliquo, ad umbilicum subreflexo. Diam. maj. 42½, min. 36, axis 20 mm.; apertura 23 lata, 17 oblique alta.

HAB. In montibus 'Aghastyamullay' dictis, inter provincias Tinnevelley atque Travancore, in Indiâ meridionali (H. Beddome).

Shell narrowly umbilicate, depressed, subcarinate, yellowish chestnut, paler and dull yellow below around the umbilions, surrounded by a narrow pale band, which is only well marked near the mouth; the sculpture is fine and subgranulate, formed by decussating strize of growth and fine spiral lines, the latter disappearing below near the umbilicus. Spire depressedly convex, apex obtuse; suture linear, and not impressed, except in the anterior half of the last whorl. Whorls 41, all except the last flat, gradually increasing; the last whorl more convex above, especially towards the mouth, where it is slightly broader, subangulate at the periphery, convex below. but a little compressed close to the mouth. Aperture oblique, broader than high, lunately semioval, subangulate at the upper portion of the outer edge, pale livid within, with the narrow whitish band along the blunt keel very conspicuous. The peristome is not thickened, except very slightly along the basal margin, which is white, oblique, and straight for a considerable distance, being very slightly reflected at the umbilicus; the other margins are regularly convex, the upper and lower margins being subparallel; the callus connecting the free margins of the aperture is thin, but granular. Major diameter 1.72 inches, minor 1.4, axis 0.8; aperture 0.95 inch broad, 0.68 high (measured obliquely).

Col. Beddome has sent to me two specimens of this shell, one adult, the other not quite fully grown. The species is near *H. tinostoma*, but is considerably smaller, and the peculiar flattening and compression of the last whorl, near the mouth, is far less, the aperture being, in consequence, not nearly so broad in proportion to the height. Another allied form, also

from Travancore, is *H. basilessa*; but this is a thicker shell, with broader whorls and rather a thick lip to the aperture; the sculpture, too, is different. None of the remaining species of *Hemiplecta* occurring in the Malabar province have the mouth compressed.

5. XESTINA* ALBATA, sp. nov., Pl. III, Fig. 3, 8a., 3b.

Testa angustissime atque subobtecte umbilicata, depresso-globosa, solidiuscula, rugoso-striata, lineis impressis distantibus spiralibus superne
circumdata, albida, eburnea. Spira depresso-conica, apice obtuso, suturd
impressd. Anfr. 5½, convexiusculi, sensim accrescentes, primi translucentes, sublævigati; ultimus primum, nec antice, ad peripheriam subangulatus,
aperturam versus latior, vix descendens, subtus subinflatus. Apertura obliqua, late lunaris; peristomate superne simplici, extus subtusque subreflexo,
juxta umbilicum reflexo atque subincrassato, margine basali arcuato. Diam.
maj. 29, min. 23½, axis 17½ mm.; apert. intus 15 lata, 14 oblique alta.

HAB. Ad Papanassam, in montibus ad latus occidentale provincise Tinnevelly, Indiæ meridionalis (H. Beddome).

Shell very narrowly and subobtectly umbilicate, depressedly globose, subangulate at the periphery, rather solid, ivory-white, the surface wrinkled, forming a coarse oblique striation across the whorls, with fine spiral distant impressed lines on the upper surface only of the two last whorls. Spire depressedly conical, apex obtuse, suture impressed. Whorls 5½, slightly convex, regularly increasing, the first almost smooth and translucent; the last whorl at first subangulate at the periphery, the angulation disappearing some distance behind the mouth, the lower portion inflated near the aperture, which is oblique and broadly lunate. Peristome simple above, subreflected on the outer and basal margins, rather thicker and turned back near the umbilicus, which it partly covers; the basal margin is curved forwards. Major diameter 1.5 inch, minor 0.95 axis 0.7; breadth of aperture inside 0.6, height (measured obliquely) 0.56.

This form is allied to X. maderaspatana (Helix maderaspatana, auct.), but it is thicker, much more coarsely sculptured, and white in colour. The peristome too is slightly reflected. There is some resemblance also to X. belangeri in form, but the mouth is somewhat differently shaped, and the sculpture of X. albata is coarser. X. belangeri appears to be a near ally of X. tranquebarica, semirugata, and bombayana, forms differing in shape, but so variable and so closely allied that it is very doubtful whether they really merit distinction. All of these forms have a horny shell differing from the ivory-white substance of the species now described.

^{*} Pfeiffer, J. B. Jahrbuch d. Mal. Ges. v, p. 257.

But a single specimen has been sent by Col. Beddome. I think I have seen the same, or a very similar form, from either the Pulneys or some other range of Southern India; but I cannot find specimens in my collection.

6. EUPLECTA VIDUA. Plate II, Fig. 5.

Holix vidua, W. Bl., MSS.; Hanley, Conchologia Indica, pl. cxxx. figs. 2, 3.

Nanina climacterica, Bens., var. vidua, Nevill, Hand-list Mollusca, Indian Museum,
Calcutta, pt. i. p. 30.

Testa imperforata, conoideo-depressa, superne oblique confertim atque arcuatim filiformi-costulata, subtus lævigata, polita, radiatim striatula, superne pallide cornea, subtus pallidior. Spira depresso-conica, lateribus subrectis, apice acutiusculo, suturd impressa. Anfr. 8, convexi, arcti, lente accrescentes; ultimus superne ad peripheriam angulatus, antice vix descendens, subtus convexus. Apertura obliqua, lunaris, latior quam alta. Peristoma obtusum, leviter sinuatum, intus vix albo-labiatum, margine basali arcuato, columellari vix reflexo. Diam. maj. 17, min. 15\frac{1}{2}, axis 9\frac{1}{2}, mm.

HAB. In montibus Garo Khasi et Naga dictis, vallem Assamensem meridiem versus contingens (Masters, Godwin-Austen).

Varietas minor, depresso-turbinata, spirá conicá. Diam. maj. 14, min. 12½, axis 9 mm. (Pl. II, Fig. 2.)

HAB. Cum præcedente.

Shell imperforate, conoidly depressed, above ornamented with oblique, close, and arcuate fine hair-like costulation, smooth and marked with radiating strise below; pale horny, paler beneath. Spire depressedly conical, the sides nearly straight, apex rather sharp, suture impressed. Whorls 8, convex, narrow, slowly increasing in size, the last angulate above at the periphery, scarcely descending towards the mouth, convex below. Aperture oblique, lunate, broader than high. Peristome not sharp, slightly wavy, with a very slight white thickening inside, the basal margin curved forward, the columellar scarcely reflected. Major diameter 0.67, minor 0.62, axis 0.38 inch.

The above is the typical form; but there is a smaller variety, depressedly turbinate in shape, with the spire conical, measuring 0.55 inch in its major diameter and 0.36 in height. This form passes by insensible gradations into the type.

The shell represented in the 'Conchologia Indica' is intermediate between the two varieties here described and figured; the apex in the 'Conchologia' figure is more prominent and blunt than in the specimens now before me. These were procured from the Naga hills, south of Gola Ghat, Assam, by Mr. Masters in 1859; other specimens were subsequently

found on the Garo, Khasi, and Naga hills by Colonel Godwin-Austen. The shells from the Khasi hills have the filiform costulation on the upper surface finer and less regular than those from the Assam side of the Naga hills. In Khasi shells 2, 3, or 4 ribs occur at nearly regular intervals, and then a rib appears to be omitted; this is not the case with those from upper Assam.

The species scarcely differs from E. creatissima, found on the other side of the Brahmaputra valley at the base of the Sikkim hills, except in being imperforate. E. climacterica, of which Mr. Nevill considers the present shell a variety, is always sharply keeled at the periphery. The two forms may pass into each other, but I have never seen any intermediate links; and as they differ from each other much more than E. vidua does from E. creatissima, or E. climacterica from E. austeni, it is better to have distinctive names for them.

I am indebted to Col. Godwin-Austen for the following note on the animal of *E. vidua* observed at Cherra Poonjee, Khasi hills.

"Animal of a neutral grey tint about the neck and eye-tentacles, which are rather long and fine, the oral tentacles are also of a dark tinge. Extremity of foot truncated, with mucous gland. Body long and thin. No tongue-like processes to the mantle observed."

The genus Euplecta was proposed by Semper* for two Ceylonese shells Helix subopaca and H. layardi. The latter of these is referred by both Theobald† and Nevill‡ to Situla, a position which is scarcely tenable, for the animal of H. layardi is destitute of shell-lobes, whilst these are present in Situla§; and the odontophores are very different, neither the shape nor number of the teeth being similar. At the same time, I am rather doubtful whether H. layardi should not be placed in a separate section from H. subopaca on account of differences both in the shell and odontophore. The last-named species, however, is, I think, to be accepted as type. It is greatly to be regretted that Semper should have adopted so loose and uncertain a proceeding as to name two distinct forms as types of one genus. In such a case, the only plan is to take the first-named—in this case, H. subopaca—as the type of Euplecta.

The genus is thus defined by its author in German:—On the mantle edge only neck-lobes are present, the left is divided into two separate lappets (as in many Helices). Above the caudal gland there is a short horn. The shell entirely exterior, ribbed or striated above, smooth below. On the

[•] Reisen im Archipel der Philippinen, 2te theil, Wis. Res. vol. iii, p. 14.

[†] Cat. p. 20.

[†] Hand-list, p. 34.

[§] See, for description of the animal and odontophore of Situls (or Conulems, which is the same), Stoliczka, J. A. S. B., 1871, vol. xl, pt. 2, p. 236.

genital organs a cylindrical female supplementary gland (Anhangsdrüse) with a cartilaginous point (analogous to the dart?); on the vas deferens (Samenleiter) a closed appendage, in which calcareous concretions are formed, and a flagellum.

The odontophore is not noticed in the generic description. In *E. subopaca*, the number of teeth in each cross-row is about 100, central tooth tricuspid, the neighbouring laterals 12 in number distinctly bicuspid, from the 13th to the 24th almost without a trace of the little lateral point, which, however, reappears in the outer laterals. *Euplecta* belongs to Semper's subdivision *Ceratophora* with a horn-like lobe above the caudal gland, and the sole of the foot divided into a central and two lateral regions as in *Macrochlamys* (and *Stenopus*).

In the characters of both shell and animal, so far as we know the latter, there is a remarkable resemblance between *E. subopaca* and *E. vidua*. The connection between *E. vidua* and *E. climacterica* has already been noticed, and in the latter the odontophore (of which Col. Godwin-Austen has kindly furnished me with notes and drawings) agrees very closely with that of *E. subopaca*. The following is a description of the teeth in *E. climacterica*:—

"Median tooth tricuspid, the central point very long, the lateral cusps very small. The first 14 laterals are long and broad with a single short small cusp on the lower outer margin, the 25 outermost are long narrow, curvilinear, bicuspid, the outer point the shorter, being less than half as long as the inner. Jaw slightly curved, the front edge a little convex."

The number of teeth in a row is apparently 79. A sketch shews that the form of both central tooth and laterals is very similar to that in *E. subopaca*.

Euplecta is by Semper classed apart from Rotula. The animal of the type of this latter genus (H. detecta, from Bourbon) is still unknown. Semper has described the anatomy of two very different species, and there is no proof that they are congeneric. It is also extremely doubtful whether, of the forms referred to Rotula by Stoliczka,* any belong really to the section; and I am disposed to believe that Nevill was right in removing them in his 'Hand-list,' where, however,† he simply classes them in Nanina without specifying any subgeneric group. Judging, it is true, chiefly from the shells, I should class the following Indian and Burmese species in Euplecta:—

Helix ponsa, Benson; from Burma.

[•] J. A. S. B., 1871, xl, pt. 2, p. 231; 1873, xlii, pt. 2, p. 14.

^{† 1.} c. pp. 28, 29, 30, &c.

[‡] I find this short note on specimens of this species obtained in upper Burma in 1861:—Animal of the vitrinoides type, but the projecting lobe (i. s., that above the caudal gland) is small.

Nanina sikrigallensis, Nevill; Bengal, Behar (Hand-list, p. 28).

Helix climacterica, Benson; Assam hills, Burma.

Euplecta vidua, Assam hills.

Nanina austeni, W. Bl.; Garo hills, Assam.

N. falcata, W. Bl.; Garo hills, Assam.

Helix ornatissima, Benson; base of Himalayas, Sikkim and Nipal.

Helix serrula also probably belongs to the same genus. About H. anceps and its near ally, H. arata, I am more doubtful; for there are shell-lobes to the mantle in the former, and the teeth of the odontophore differ in several particulars.*

As regards H. indica (Pfr. nec Benson), H. shiplayi, and H. acuducta, I cannot now find the notes I made many years since on the animals, but I believe they belong to the forms allied to Ariophanta, in which the foot is broad with the sole undivided, and there is no projecting lobe above the caudal gland. The shells present much resemblance to the type of Albers' section Thalassia. H. tugurium and H. camura from Sikkim are still more like H. subrugata from Australia, the type of Thalassia.

7. Sesara? ingrami.

Helix ingrami, Blanford, Hanley, Conchologia Indica, pl. lx. figs. 9, 10.

Rotula diplodon, Bs., partim, Theobald, Cat. Land & Freshwater Shells Brit. Ind.
p. 21.

Nanina (Sesara ?) diplodon, Bs., partim, Nevill, Handlist Moll. Ind. Mus. pt. i. p. 53.

Testa imperforata, trochiformis, tenuis, diaphana, pallide cornea, minutissime atque confertissime granulatim decussato-striata. Spira subconica, lateribus eonvexiusculi, apice obtuso, suturd parum impressa, linea filiformi marginata. Anfr. 6½, regulariter accrescentes, vix convexiusculi, superiores lævigati; ultimus acute carinatus, non descendens, et supra et infra carinam compressus, basi extus decussato-striatus, atque, præsertim antice, aperturam versus, planulatus, intus convexiusculus atque lævigatus, striis medium versus evanescentibus, regione umbilicali impressa. Apertura diagonalis, incurvo-triangularis, intus tridentatus, dentibus lamelliformibus omnibus basalibus, duobus in peristomate, uno majori falcato intrante, extus convexo, in medio margine basali, alio minori obliquo subcolumellari, tertio profundo, incurvo, transversim post majorem posito. Peristoma album, modice incrassatum, margine basali sinistrorsum arcuato, dextrorsum subangulatim sinuato, columellari vix reflexo. Diam. maj. 6½, min. vix 6, alt. 4½.

HAB. In montibus 'Yoma' dictis, Pegu ab Arakan secernentibus, haud procul a vico Tongoop.

Stoliczka, J. A. S. B., 1871, xl, pt. 2, pp. 284, 286.

Shell imperforate, trochiform, thin, translucent, pale horny, very minutely and closely striated both obliquely and spirally, so as to be covered, except on the upper whorls, with fine almost granular decussated sculpture. Spire nearly conical, with the sides slightly convex; apex obtuse; suture very little impressed, and with a filiform line above, the continuation of the keel on the last whorl. Whorls 61, increasing regularly, nearly flat, only a little convex, the uppermost quite smooth, the sculpture growing stronger on the lower whorls; the last whorl sharply keeled, not descending, compressed both above and below the keel, with the outer portion of the base flat, especially towards the mouth, and decussated, the inner portion moderately convex and smooth, the sculpture gradually disappearing towards the middle; umbilical region impressed. Aperture diagonal, triangular with the sides curved, with three lamelliform teeth inside, all palatal, and in the basal margin: the largest is in the middle of the margin, and is much curved, with its convex side outwards; it begins by forming a kind of thickening to the lip, and then curves away into the interior of the whorl; the second is smaller, oblique, and situated near to the columellar margin; the third is at some distance within the aperture, it is curved, and placed transversely behind the first. Peristome white, somewhat thickened, the basal margin curved forwards near the umbilical region, and angulately curved back near the periphery of the shell; columellar margin scarcely reflected. Major diameter 0.25, minor 0.23, height 0.18 inch.

In the figure in the 'Conchologia Indica,' the internal tooth is not shown, although all the teeth are clearly seen through the semi-transparent base of the shell.

The caudal pore in the animal is very small, and furnished with a lobe in front of it, but the tail is not truncated abruptly as in *Macrochlamys*. This is the only note I can find on the soft parts.

This shell was named in MS. in the year 1861, and a specimen transmitted to Mr. Benson, who, however, doubted whether it could be distinguished from the Khasi-hill form described by him as *Helix diplodon*. The typical specimen of the latter must, I think, have been in poor condition, for it was described as "lavigata, parum striatula", whereas fresh specimens exhibit nearly the same fine subgranulate decussating striation as S.? ingrami, and Mr. Benson very probably, and very justly, thought that fresh specimens might agree with the Arakan shell in other characters. Subsequently, fresh specimens of S.? diplodon were obtained from the original locality by Colonel Godwin-Austen; and I find that they differ from S.? ingrami not only in being minutely perforate, a character to which by itself I should attach little or no importance, but also in having but two teeth in the aperture instead of three, the internal transverse tooth of S.? ingrami being deficient in S.? diplodon, whilst the other teeth are

differently shaped. The sculpture is somewhat finer in S.? diplodon, and the basal margin of the aperture is subangularly concave, without the curving forwards due to the transverse portion of the larger tooth in S. ingrami. The last character is well shown in the 'Conchologia' figure.

8. MACROCHLAMYS? PLATYCHLAMYS, sp. nov., Plate 1I, Fig. 9.

Testa perforata, conoideo-depressa, pertenuis, nitida, lævigata, sub lente obsolete striatula, fulvo-cornea. Spira parum elevata, apice obtuso, sutura levi aliquando marginata. Anfr. 5, vix convexiusculi, regulariter accrescentes; ultimus non descendens, peripheria rotundatus, subtus convexus. Apertura obliqua, lunaris, latior quam alta. Peristoma tenue, simplex, leviter sinuatum, marginibus remotis, callo tenuissimo junctis, columellari brevissime verticali, peranguste reflexo. Diam. maj. 11, min. 9½, axis 5½.

Animal pallio maximo indutum, duos lobos latos linguiformes emittente, qui spiram testa omnino circumtegunt.

HAB. Ad. Bombay.

Shell perforate, conoidly depressed, very thin, smooth, and polished, obsoletely striated beneath the lens, fulvous horny in colour. Spire subconical, but little raised, apex obtuse; suture smooth, scarcely impressed, sometimes marginate. Whorls 5, very slighly convex, regularly increasing in size, the last not descending, rounded at the periphery, convex below. Aperture oblique, lunate, broader than high. Peristome thin, simple, slightly curved when viewed from the side; margins distant and united by a thin callus; the columellar border vertical for a very short distance, slightly reflexed. Major diameter 0.44, minor 0.38, axis 0.22 inch.

This shell belongs to the group of thin, more or less depressed forms allied to the type usually known as *M. vitrinoides* (*M. indicus*, Benson). It appears, so far as I can see, to be undescribed, as is also, I believe, an allied form of darker colour, and with a subangulate periphery, occurring at Trichinopoly and elsewhere in the neighbourhood of the Coromandel coast south of Madras.

The animal of *M. platychlamys* is chiefly distinguished by the peculiarly broad shell-lobes, which, instead of being narrow and attenuate towards the ends, as in most allied species, are broad and flat, so as sometimes to cover the whole spire, and usually to conceal all except a narrow band. These lobes somewhat resemble those in the genus *Helicarion*. The lobe above the caudal gland is very much smaller than it usually is in *Macrochlamys* and rounded, not horn-shaped.

This shell is common in the island of Bombay and neighbouring lowlands on the west coast of India, and I have seen a form from the hills of the Wynaad in Southern India that appears undistinguishable. I have also several specimens of a *Macrochlamys* from the ancient town of Champanir, near Broach, that may very possibly be a variety of *M platychlamys*. The specimens are larger than the Bombay types, an adult measuring 16 mm. by 14 in its two diameters, and some individuals attain even greater dimensions; the mouth too is rather more convex beneath, but otherwise the two forms agree very closely.

The figure gives the idea of a rather thick shell, and the form of the mouth is incorrect, being too convex below and, consequently, too high in comparison with the breadth.

9. MACROCHLAMYS TENUICULA. Pl. II, Fig. 8.

Macrochlamys tenuicula, H. Ad., P. Z. S. 1868, p. 14, pl. iv, fig. 9.

Helix tenuicula, Pfr., Mon. Hel. vii. p. 94.—Hanley, Conch. Ind. pl. lxxxix, figs. 7, 10.

Macrochlamys effulgens, W. Bl., MSS.—Theobald, Cat. Land and Freshwater Shells of British India, p. 18.

Nanina (Macrochlamys) effulgens, Nevill, Hand-list Mollusca, Indian Museum, Calcutta, part i. p. 26.

Nanina (Microcystis?) tenuicula, Nevill, ib. p. 36.

Testa aperte perforata, turbinata, tenuis, flavo- vel fulvo-cornea, lævigata, nitida, diaphana, oblique striatula, sub lente lineis impressis confertis minutis in anfractibus superioribus subtilissime decussata. Spira subconica, lateribus convexiusculis, apice obtuso, sutura leviter impressa. Anfr. 5\frac{1}{2}-6, convexiusculi, regulariter crescentes, ultimus non descendens, ad peripheriam obsolete subangulatus, angulo omnino antice evanescente, sed in testis junioribus validiore, subtus convexus, radiatim striatulus. Apertura obliqua, ovato-lunaris, latior quam alta. Peristoma tenue, rectum, marginibus subconniventibus, columellari subverticali, breviter reflexo. Diam. maj. 9, min. 8\frac{1}{4}, axis 6 mm.

HAB. Ad Bombay et in terris vicinis, necnon in montibus 'Western Ghats' seu 'Syhadri' dictis.

Shell openly perforate, turbinate, thin, yellow or fulvous horny, smooth, polished, transparent, obliquely striated, and under the lens finely decussated on the upper whorls with minute, close, impressed spiral lines. Spire subconical, the sides a little convex, apex obtuse, suture slightly impressed. Whorls $5\frac{1}{4}$ -6, rather convex, regularly increasing, the last not descending, obsoletely subangulate at the periphery (in immature shells distinctly angulate), the angle disappearing near the mouth, convex below and radiately striated. Aperture oblique, ovately lunate, broader than high. Peristome thin, straight, the margins approaching each other slightly, columellar

margin subvertical, reflected for a short distance. Major diameter 0.36, minor 0.33, axis 0.24 inch. The foot of the animal is very long and narrow, and there are the usual pointed shell-lobes to the mantle. The colour of the body is almost black.

The shell described by the late Mr. H. Adams as Macrochlamys tenuicula appears to me almost certainly to be the immature form of a species common in Bombay. This form I have had for many years; and I formerly distributed specimens under the MSS. name of Helix effulgens, a name which has unfortunately got into print. The adult shell has never been described; but the specimen figured in the 'Conchologia Indica' must have been nearly full-grown. Mr. Adams's original types were said to be from Sattara. It is probable they came from the Western Ghats in the Sattara district; but the species may extend to the damper portions of the Deccan plateau.

The figures herewith given are very unsatisfactory; the left-hand figure is quite inaccurate. This, however, is of less importance, as the shell is very fairly represented in the 'Conchologia Indica.'

10. MACROCHLAMYS? PLICIFERA.

Nanina plicatula, W. Bl., J. A. S. B., 1870, xxxix, pt. 2, p. 13, pl. iii, fig. 7. nec N. plicatula, Mart., Nachrichtsbl. mal. Gesellsch., 1869, i, p. 149.

Helia plicatula, Hanley, Conch. Ind., p. 14, pl. xxviii, fig. 1.

Macrochlamys plicatula, Theobald, Cat. Land and Freshwater Shells Brit. Ind. p. 19. Nanina, n. sp., Nevill, Hand-list Moll. Ind. Mus. Calcutta, p. 27.

I am indebted to Mr. Nevill for calling attention to the fact that the name I gave to this shell was pre-occupied. I propose to change the specific title to *plicifera*.

11. MACROCHLAMYS? WYNNEI, sp. nov., Plate III, Fig. 5, 5a.

Testa perforata, subturbinato-depressa, striatula, nitida, albido-cornea, diaphana, fascia rufa supra peripheriam circumdata. Spira depresso-conica, apice obtuso, sutura leviter impressa, fascia rufa intus marginata. Anfr. 5½, lente accrescentes, ultimus peripheria rotundatus, subtus modice convexus, aperturam versus vix descendens. Apertura late lunaris, obliqua, diagonalis; peristoma tenue, intus haud incrassatum, margine basali subrecto obtuso, columellari reflexo. Diam. maj. 19, min. 17½, axis 9½ mm. (ex icone). In exemplo minore diam. maj. 13½, min. 12½, axis 7½ mm. apert. 7 lata, 6 oblique alta.

HAB. Ad Mari (Murree) in montibus Himalayanis occidentalibus inferioribus haud procul a flumine Jhelum (A. B. Wynne).

1880.]

Var. major, depressa, anfractibus 6, spird convexa, parum elerata: diam. maj. 21½, min. 19½, axis 10 mm., apert. 11½ lata, 10 oblique alta.

Hab. Etiam ad Mari.

Shell perforate, subturbinately depressed, faintly striated, polished white, translucent, surrounded by a narrow rufous band above the periphery. Spire depressedly conical, apex obtuse, suture slightly impressed, and with a rufous margin inside. Whorls 5½, increasing slowly and regularly, the last rounded at the periphery, moderately convex beneath, scarcely descending towards the mouth. Aperture broadly lunate, oblique, diagonal; peristome thin, not thickened inside, basal margin almost straight, columellar reflected. Major diameter 0.76, minor 0.7, axis 0.37 inch (taken from the figure). A smaller specimen measures:—major diam. 0.54, minor 0.5, axis 0.3, breadth of aperture 0.27, height (obliquely measured) 0.23 inch.

There is a larger variety, more depressed, with the spire convex and six whorls. It may possibly be a distinguishable form, but I think not. A specimen measures:—major diameter 0.85, minor 0.78, axis 0.42, breadth of aperture 0.45, height (obliquely measured) 0.4.

I greatly question whether this form is really a *Macrochlamys*, and cannot help suggesting the possibility of its belonging to a different subgeneric group, or even to *Zonites*. However, it is associated at Mari with a true *Macrochlamys* (*M. prona**) and two or three species of *Helicarion*; so it is evident that a few of these tropical types extend to this extreme north-western portion of the Himalayan range, where, however, the majority of the mollusca consist of *Bulimini* of the *Petrœus* section.

The specimen of *M. wynnei* from which the accompanying figure was taken has been mislaid or lost, and the description is drawn up from a smaller individual. I have named the shell after Mr. A. B. Wynne of the Geological Survey of India, to whom I am indebted for several mollusca from the neighbourhood of Mari.

I have been in some doubt as to whether this might not be a form of the shell described by Prof. v. Martens as Nanina jacquemonti (Malak. Bl. xvi. 1869, p. 75; Pfr. Nov. Conch. iv. p. 48, pl. cxviii, figs. 6-8); but, in the first place, it can scarcely, I think, be the species figured by Jacquemont (Voyage dans l'Inde, Atlas, pl. xvi. fig. 2), and, secondly, N. jacquemonti is described as having "peristoma obtusum, intus incrassatum, margine...basali leviter arcuato," none of which can apply to the present species. Pfeiffer's figure in the 'Novitates' shows a very much less oblique mouth than is found in Macrochlamys? wynnei. Now, I have another species from Mari, which agrees admirably with Marten's description in these re-

^{*} Nevill, 'Scientific Results of the Second Yarkand Mission,' Mollusca, p. 17.

spects, and which resembles Jacquemont's figure also, but it wants the red band round the periphery shown in Pfeiffer's figure. It is just possible that two species are included by Martens. The true *N. jacquemonti* is probably a *Bensonia*.

12. Pupa (Pupisoma) evezardi.

"Pupa (Pupisoma) evezardi, Blanford," Nevill, Hand-list Moll. Ind. Mus. Calcutta, pt. i. p. 192.

?" Pupa evezardi, Blanford MS.," Hanley, Conch. Ind. p. 41. pl. ci, figs. 5, 6.— Theob. Cat. Land & Freshwater Shells Brit. Ind. p. 30.—Pfr. Mon. Hel. viii. p. 415.

Testa imperforata, vix subrimata, conoideo-ovata, tenuis, cornea, lineis elevatis irregularibus filiformibus obliquis ornata. Spira subtus subcylindracea, superne conoidea, lateribus convexis, apice obtuso, sutură impressă. Anfr. 4½, convexi, regulariter crescentes, ultimus parum major, peripheria atque basi rotundatus, haud antice descendens. Apertura diagonalis, truncato-rotunda, edentula; peristoma tenue, rectum, expansiusculum, marginibus conniventibus, columellari verticali, ad basin subtorto, adnato-reflexo, regionem umbilicalem tegente. Long. 2½, diam. fere 2, long. ap. 1 mm.

Hab. In cortice arborum ad Khandalla inter Bombay et Poons (G. Evezard).

Shell imperforate, with scarcely even a trace of rimation in the umbilical region, conoidly ovate, thin, horny, with raised hair-like oblique lines, rather irregularly disposed, on all the whorls. Spire nearly cylindrical below, conoidal above, the sides convex, apex blunt, suture impressed. Whorls 4½, convex, increasing in size regularly; the last but little larger than the penultimate, rounded at the periphery and below, not descending in front. Aperture diagonal, nearly circular, but truncated above, without teeth; peristome thin, all in one plane, slightly expanded, margins converging; columellar vertical above, slightly twisted below, reflected and united to the whorl so as completely to cover the umbilicus. Length 0.11, diameter 0.08, length of aperture 0.04 inch.

If the form represented by Hanley in the 'Conchologia Indica' be precisely the same as that described above, I am inclined to question the locality given, "Singhur," or, as Mr. Theobald prefers writing it, "Synghar," presumably Sinhgarh, near Poona. The original specimens were found by Colonel Evezard at Karkalla, near Khandalla, at the head of the Bor-ghat; and I suspect that Hanley's figure was taken from one of them. There are two or three allied forms found in the Syhadri range and the Nilgiris, forms that do not appear hitherto to have been described.

The subgenus Pupisoma was proposed by Stoliczka* for the Moulmein

[•] J. A. S. B., 1873, vol. xlii. pt. 2, p. 82.

P. lignicola,* a form very closely resembling P. evezardi, but rather shorter and less ovate. It is by no means improbable that intermediate varieties may be found; indeed, so much do I doubt whether the two are really worthy of distinction that I should not have described the present species if the name had not already crept into print.

Mr. Nevill, in his Hand-list *l. c.*, has referred the *Helix orcula* of Benson to the same section of *Pupa* as *P lignicola*; and in this he is, I think, unquestionably right.

13. SUCCINEA COLLINA.

"S. collina, Blanford, MS.," Hanley, Conch. Ind. p. 30, pl. lxviii. figs. 8, 9, 10; Theobald, Cat. Land and Freshwater Shells Brit. Ind. p. 31; Pfr., Mon. Hel. viii. p. 558; Nevill, Hand-list Moll. Ind. Mus. pt. i. p. 212.

Testa conico-ovata, tenuiuscula, parum nitida, distincte atque flexuose striata, viridescenti-cornea. Spira scalaris, apice acutiuscula, suturâ valde impressă. Anfr. vix 3, perconvexi, ultimus ‡ longitudinis subæquans. Apertura ovata, obliqua; peristoma tenue, margine dextro mediocriter arcuato; columella arcuata, recedens, callosa. Long. 17, diam. 10, alt. (v. diam. min.) 6 mm., apertura 13 mm. longa, vix 9 lata.

HAB. Saxis rupibusque adhærens prope Mahabaleshwar ad summos montes 'Syhadri' seu 'Western Ghats' dictos Indiæ occidentalis.

Var. aurantiaca v. rufo-cornea; habitat in colle 'Iorna' dicto, inter Mahabaleshwar atque urbem Poona.

Shell conically ovate, rather thin, but little polished, distinctly and flexuously striated, greenish horny in colour. Spire step-like, apex rather pointed, suture much impressed. Whorls scarcely 3, very convex, the last about $\frac{2}{3}$ of the length. Aperture oval, oblique; peristome thin, the right margin moderately curved forwards; the columella arcuate, receding, and covered with a thin callus. Length 0.76, diameter 0.4, height (when laid mouth downwards) 0.24 inch; length of aperture 0.52, breadth 0.36 inch. The largest shell I possess measures 20 mm. in length (0.8 inch). A rufous variety occurs at Torna Hill, near Sinhgarh, west of Poona.

This is a rock-inhabiting species,† found on cliffs and large blocks of basalt at Mahabaleshwar and Torna, and is allied to S. girnarica, a larger and thicker form, rather differently shaped, found by Mr. Theobald

[•] J. A. S. B., 1871, vol. xl. pt. 2, p. 171.

[†] It is rather difficult to understand why Succinea should be placed amongst freshwater shells in the 'Conchologia Indica.' Most of the Indian forms are found either on trees (often on palms) or on rocks, and generally at a distance from water. Lithetic and Camptonyx are also, I think, incorrectly classed as freshwater shells, both being found on basaltic cliffs.

on the basaltic rocks of Girnar Hill, in Kattywar. The animal of S. collina bears a considerable external resemblance to that of the subgenus Lithotis, which has a similar habitat.

The figures in the 'Conchologia Indica' give a fair idea of the species, but the spire in fig. 8 is rather too large.

14. STREPTAXIS COMPRESSUS, sp. nov., Plate II, Fig. 13.

"S. compressus, Wl. Bl.," Theobald, Cat. Land and Freshwater Shells Brit. Ind. p. 33.

Testa subaperte sed non pervie umbilicata, valde depresso-ovata, cereoalbida, diaphana, nitida, vix striatula. Spira vix convexa, fere plana,
sutură parum impressă. Anfr. 4½, penultimus postice compressus, obtuse
sed prominenter carinatus; ultimus valde eccentricus, antrorsum devians,
subtus planulatus politusque, circa umbilicum, præsertim antice, angulatocoarctatus, pone aperturam fossiculis impressis constrictus. Apertura diagonalis, semiovalis, lamind und validă subbifidă intrante parietali, dente
uno duplici columellari, tribus palatalibus in margine dextro, coarctata.
Peristoma incrassatum, undique sublate expansum, postice juxta angulum
mediocriter sinuatum, marginibus callo lamellifero junctis. Diam. maj. 6½,
min. 3½, alt. vix 3; ap. long. 2½, lat. 2 mm.

HAB. In montibus 'Sivagiri' dictis (Tinnevelly) Indiæ meridionalis (H. Beddome).

Varietas anfractibus quinque, superne et in umbilico confertim filiformi-striata, lamina parietali duplici, in montibus habitat prope urbem Cumbum. Exempli majoris diam. maj. 6½, minoris 5½, diam. min. 4 et 3½, alt. 2½ et 2½.

Shell rather openly but not perviously umbilicated, depressed, oval, yellowish white, translucent, glossy, scarcely striated. Spire almost flat, suture but little impressed. Whorls 4½, the penultimate compressed and prominently but bluntly keeled posteriorly; the last very eccentric, flattened and smooth below, and angulately compressed around the umbilicus, and especially near the mouth, where there are indentations corresponding to the teeth inside. Aperture diagonal, semioval, and furnished with five teeth, one strong re-entering bifid plait on the parietal callus uniting the margins of the peristome, one large double tooth on the columellar side, three palatal teeth on the right side. Peristome thickened and expanded, curved back near the posterior angle. Major diam. 0.25, minor 0.15, height 0.11 inch.

A variety from the Cumbum hills has distinct but very fine close filiform raised lines on the upper surface and inside the umbilious, and the parietal lamina is double. Some specimens are rather smaller than the type. It is doubtful whether these differences justify a separate name.

- 15. STREPTAXIS PERSONATUS, sp. nov., Plate II, Fig. 10.
- "S. personatus, Wl. Bl.," Theobald, Cat. Land and Freshwater Shells Brit. Ind. p. 33.

Testa umbilicata, depressa, sphæroideo-ovata, lævigata, nitidula, diaphana, cereo-albida. Spira depressa, apice vix exserto, sutura impressa. Anfr. 5, convexi, penultimus postice rotundatus, vix ultra ultimum (a basi spectatus) projiciens; ultimus eccentricus, antrorsum devians, subtus convexus, circum umbilicum compressus, post aperturam fossiculis impressis constrictus. Apertura obliqua, fere semiovalis, lamina una valida flexuosa intrante parietali, dentibusque 5, tribus in margine columellari, duobus in destro, harum uno inferiore majore laminæ parietali opposito, alio minore superiore, coarctata. Peristoma incrassatum continuum, fere solutum, album, undique late expansum, postice juxta angulum subprofunde retrosinuatum, margine parietali valido, concavo. Diam. maj. 5, min. 3½, alt. 2½.

HAB. In montibus haud procul ab urbe Cumbum (Madura) India meridionalis (H. Beddome).

N. B. In nonnullis exemplis peristoma quadri-vel tridentatum nec quinquedentatum est, dente uno columellari et aliquando uno palatali carens.

Shell umbilicated, depressed, spheroidally ovate, smooth, moderately polished, translucent, pale yellowish white. Spire depressed, the apex scarcely exserted, suture impressed. Whorls 5, convex, the penultimate rounded behind, scarcely projecting beyond the last when seen from below; the last eccentric, convex below, compressed around the umbilicus, and constricted by pits corresponding to the teeth inside, just behind the mouth. Aperture oblique, irregularly semioval, and furnished with one strong re-entering parietal lamina, curved inside, and with five teeth, three on the columellar margin, two on the right; of the latter the lower is larger and opposite to the parietal lamina, the smaller is above, nearer to the angle. Peristome thickened, continuous, almost free (the thick callus which unites the columellar and dextral margins projecting from the last whorl, in a hollow curve, the concavity corresponding to the parietal lamina); the outer margins expanded, the right margin deeply recurved close to the posterior angle. Major diameter 0.2, minor 0.15, height 0.1 inch.

In other specimens, rather worn, and with the peristome somewhat less developed, the teeth are rather smaller, the upper columellar tooth is wanting, and in one case the upper tooth on the right margin is also deficient. All, however, are characterized by the great development of the parietal callus.

16. STREPTAXIS CONCINNUS, sp. nov., Plate II, Fig. 11.

Testa umbilicata, depressa, globoso-ovata, striatula, nitidula, diaphana, cereo-albida. Spira depresso-conica, parum exserta, apice obtusiusculo, suturd impressa. Anfr. 5, convexi, penultimus postice rotundatus, haud ultra ultimum (a basi spectatus) projiciens; ultimus inflatus, multo major, eccentricus, antrorsum devians, subtus convexus, lævigatus, politus, circum umbilicum praesertim antice compressus, post aperturam fossiculis impressis constrictus. Apertura obliqua, fere semiovalis, lamellis duobus intrantibus parietalibus, sinistra longiore, intus torta, dentibusque 5, duobus columellaribus, superiore minore juxta umbilicum, inferiore magno duplici, uno basali lamelliformi transverso, duobusque in margine dextro, inferiore subbifido, superiore minore, coarctata. Peristoma album expansum, ad angulum postice vix sinuatum, marginibus callo duas lamellas forente junctis. Diam. maj. 5½, min. 4, alt. 3½ mm.

HAB. In montibus 'Balarangam' dictis (Mysore) Indiæ meridionalis (H. Beddome).

Shell umbilicated, depressed, globosely ovate, rather indistinctly striated, shining, translucent, pale yellowish white. Spire very low, scarcely exserted, apex blunt, suture impressed. Whorls 5, convex, the penultimate rounded behind, and not projecting, when viewed from below, beyond the lower whorl; the last whorl much larger than the others, eccentric, convex below, smooth and polished, compressed around the umbilicus, especially near the mouth, and constricted by indentations, corresponding to the teeth inside, just behind the lip. Aperture oblique, nearly semioval, and furnished with two plaits on the parietal side, that to the left (nearest to the umbilicus) longer than the other and bent inside; there are five teeth in the peristome, one on the columellar margin near the umbilicus. a second large and double nearer the base, one lamellar and transverse at the base, two inside the right margin, the lower being larger than the other and almost bifid inside. Peristome white, slightly expanded, scarcely sinuate near the angle, margins joined by a callus bearing the two parietal plaits. Major diameter 0.23, minor 0.2, height 0.13 inch.

This is the only known species from Southern India, so far as I am aware, in which, when the shell is viewed from below in the direction of the axis, the penultimate whorl does not project at all beyond the body-whorl. The transverse lamellar tooth at the base of the aperture is also peculiar.

17. STREPTAXIS PRONUS, sp. nov., Plate II, Fig. 12.

Testa umbilicata, depresso-ovata, superne confertim atque arcuatim costulato-striata, nitidula, diaphana, cereo-allida. Spira depresso-conica, parum exserta, apice obtuso, sutură parum impressă. Anfr. 5½, superiores convexiusculi, penultimus postice rotundatus, longe ultra ultimum (a basi spectatus) projiciens; ultimus valde eccentricus, antrorsum devians, subtus subplanulatus, lævigatus, in umbilico striis filiformibus flexuosis ornatus, circum umbilicum compressus atque aperturam versus angulatus, juxta peristoma scrobiculis constrictus. Apertura obliqua, truncato-ovalis, lamellă validă parietali intrante flexuosă, antice subbifidă, dentibusque quatuor, uno columellari, alio basali, duobus in margine dextro, coarctata. Peristoma incrassatum, subcontinuum, album, expansum, marginibus callo crasso lamellifero junctis, dextro prope angulum sinuatum. Diam. maj. 6½, min. 4, alt. 8 mm.

HAB. In montibus haud procul ab urbe Tinnevelly Indiæ meridionalis (H. Beddome).

Shell umbilicated, depressedly ovate, closely and arcuately ornamented above with subcostulate striation, polished, translucent, pale yellowish white. Spire low, conical, but little exserted, apex obtuse, suture but little impressed. Whorls 51, the upper slightly convex, the penultimate rounded behind and projecting considerably beyond the lower whorl when viewed from below; last whorl very eccentric, somewhat flattened beneath, smooth, except within the umbilicus, where there are fine, irregularly flexuous filiform raised lines on the surface, compressed around the umbilicus and angulate near the aperture, where there are deep indentations corresponding to the teeth inside. Aperture oblique, truncately oval, furnished with a strong re-entering parietal plait, curved within and subbifid in front, and with four teeth—one columellar, one basal, and two (of which the upper is small) inside the right margin. Peristome thickened, subcontinuous, white, expanded, the margins joined by a thick callus projecting from the body-whorl and bearing the parietal lamella. Major diameter 0.26, minor 0.16, height 0.12 inch.

This shell resembles S. compressus in form, but it wants the angulation of the penultimate whorl. The peristome is much thickened, as in S. personatus.

The forms of *Ennea* and *Streptaxis* described in this paper are the principal that have been collected in the Southern Indian mountains by Colonel Beddome, from whom I have received specimens from various localities from time to time. All of the species of *Streptaxis* are somewhat variable, and, with a large collection from South India, it would

probably be found that many intermediate varieties occur. As a rnle, the general form appears more constant than any other characters, and the teeth in the mouth vary considerably. The parietal lamells are peculiarly inconstant. Thus, the original type of Streptaxis perrotteti, the common species on the top of the Nilgiri hills, has two lamells; but I have a variety from Ootacamund in which the smaller of the two, that nearer to the angle of the mouth, is obsolete, and in other specimens from the same locality there is but a rudimentary representation of this plait. It was the form with a single lamella which was compared with S. watsons when the latter was originally described (J. A. S. B., 1860, xxix, p. 127). The variation in the teeth of Streptaxis has already been noticed in these contributions J. A. S. B., 1861, xxx, p. 359.

The genus Streptaxis is abundately represented on the various hill-groups of Southern India, especially on the higher elevations of the Syhádri, or Western-Ghat range. The most northern locality from which I possess a specimen is the hill-fort of Torna, near Sinhgarh, west of Poona, in the Bombay Presidency. The shell in question is weathered, and not in very good condition; it is a large form (that is, large compared to the minute species described in the preceding pages), measuring 11½ mm. by 8½, and it is nearly allied to the Nilgiri S. perrotteti, and perhaps still more nearly to the Ceylon S. cinqulensis.

18. Ennea Macrodon, sp. nov., Plate II, Fig. 15.

Testa flexuose rimata, subcylindrico-turrita, diaphana, nitidula, confertim capillaceo-costulata, cereo-albida. Spira elongata, sursum parum attenuata, lateribus subrectis, apice obtuso, sutura impressa. Anfr. 7, convexi, duo superiores lævigati: ultimus aperturam versus subascendens. Apertura verticalis, oblique semiovalis, lamella valida bicruri intrante parietali, alia columellari profunda, dentibusque tribus, uno tuberculiformi columellari, alio magno lamelliformi transverso basali latus dextrum versus, tertio minore in margine dextro, coarctata. Peristoma album, expansum, juxta anfractum penultimum sinuatum, marginibus callo lamellifero junctis. Long. 5, diam. vix 2, ap. long. 14 mm.

Hab. Apud Pykara in summos montes 'Nilgiri' dictos Indiæ meridionalis.

Shell flexuously rimate, subcylindrically turreted, translucent, polished, yellowish white, closely sculptured, except on the apical whorls, with fine hair-like vertical costulation. Spire turreted, elongate, diminishing very slowly in thickness upwards, the sides nearly straight, the apex blunt and rounded, the suture impressed. Whorls 7, convex, the first two smooth,

[•] Petit, quoted by Pfeiffer, Mon. Hel. i. p. 9.

the last ascending very slightly near the aperture. Aperture vertical, semioval, obliquely truncated above, and very much contracted by teeth, consisting of a strong re-entering bifid parietal* plait on the callus connecting the margins of the peristome, an internal re-entering columellar lamina, commencing at a distance within the mouth, and three teeth—one, more or less tubercular, on the left or columellar side, a second tubercular tooth on the right margin, opposite the parietal plait, and with it nearly cutting off the posterior corner of the aperture, and a third, broad, lamelliform, and transverse (parallel to the plane of the mouth) on the right side of the basal margin. Peristome white, expanded throughout, curved a little back near the angle, where it meets the penultimate whorl, the margins united by a callus bearing the parietal lamella. Length 0.21, diameter 0.075, length of aperture 0.05 inch.

I obtained several specimens of this shell near Pykara, on the Nilgiri hills of Southern India, in 1858, and for a long time supposed it to be E. pirrici of Pfeiffer,† but I noticed it as a distinct form when describing E. sculpta (J. A. S. B., 1869, xxxviii, pt. 2, p. 141), and mentioned some of its peculiarities. E. macrodon is distinguished not only from E pirrici, but also from all other Indian species of the genus, by its strong basal transverse lamelliform tooth. This character serves to distinguish the two species at all ages; for in the present species, as in E. sculpta, E. pirrici, and, doubtless, in the two forms (E. exilis and E. subcostulata) described below, the apertural teeth, and especially the parietal lamella, are well developed in immature shells even before all the whorls are completed. E. macrodon, too, is only half the size of E. pirrici, and there appear to be several slight differences in form, sculpture, and dentition.

19. Ennea subcostulata, sp. nov., Plate II, Fig. 14 (upper).

Testa arcuato-rimata, subcylindrico-turrita, diaphana, nitida, cereo-albida, confertim subobsolete costulata. Spira parum attenuata, lateribus convexiusculis, apice obtuso, suturd impressă. Anfr. 7½, convexiusculi, ultimus antice breviter ascendens. Apertura verticalis, oblique semiovalis, lamellă validă intrante bicruri, flexuosă, parietali juxta angulum, aliâ profundă columellari, et quatuor dentibus, uno columellari, duobus basalibus, quarto dextrali plicæ parietali opposito, coarctata. Peristoma expansum, albidum, juxta anfractum penultimum sinuatum, marginibus callo lamellifero junctis. Long. diam. 2, ap. long. 1½ mm.

[•] For the meaning of the terms palatal, parietal, and columellar, applied to teeth within the mouth, see Pfeiffer, Mon. Hel. ii, p. 300, note.

⁺ It was quoted as that shell, J. A. S. B., 1860, xxix, p. 126, and 1861, xxx, p. 364.

HAB. In montibus 'Shevrai' vel 'Shevroy' dictis, haud procul ab urbe Salem, Indiæ meridionalis (H. Beddome).

Shell arcuately rimate, subcylindrically turreted, translucent yellowish, white, finely and somewhat indistinctly ribbed. Spire turreted, elongate, becoming rather smaller above, with the sides rather convex, the apex blunt, and the suture impressed. Whorls 7½, moderately convex; the last whorl ascending slightly close to the mouth. Aperture vertical, semioval, obliquely truncated, with a strong re-entering parietal plait, bifid and flexuous within, near the posterior angle, a columellar lamina at a distance within the mouth, and four tubercular teeth—one columellar, two basal, and the fourth inside the right margin opposite to the parietal plait, so as partly to cut off the upper (posterior) portion of the mouth. Peristome white, expanded, except near the junction with the last whorl, where the edge is curved back somewhat; margins united by a callus, on which is the parietal plait. Length 0.22, diam. 0.075, length of aperture (including peristome) .05 inch.

I have received from Col. Beddome three specimens of this species, two of which are evidently immature; the third I believe to be full-grown, but the peristome may perhaps be more fully expanded in older examples.

E. subcostulata is allied to E. pirriei, E. sculpta, E. macrodon, and their allies, but is distinguished from all by sculpture and the form of the teeth in the mouth. It was, I believe, this species which was erroneously quoted as E. pirriei from the Shevroy hills (J A. S. B., 1861, xxx. p. 364).

20. ENNEA EXILIS, sp. nov., Plate II, Fig. 14 (lower).

Testa rimata, subcylindrico-turrita, diaphana, lævigata, nitidula, albido-cerea. Spira elongata, sursum vix attenuata, lateribus apicem versus convexis, apice obtuso, suturd parum impressd. Anfr. 6½-7, convexiusculi, ultimus antice subascendens. Apertura fere verticalis. oblique semiovalis, lamellá validá intrante bicruri parietali, aliá profundá columellari spirali, dentibusque quatuor, uno columellari, duobus basalibus quasijunctis, quartoque minore in margine dextro, coarctata. Peristoma expansum, albidum, postice juxta angulum sinuatum, marginibus callo lamellifero junctis. Long. 4½, diam. 1½, ap. long. 1 mm.

HAB. In montibus 'Balarangam' dictis provinciæ Mysore in India meridionali (H. Beddome).

Shell rimate, subcylindrically turreted, translucent, smooth, polished, yellowish white. Spire turreted, elongate, diminishing very slowly indeed below, but more rapidly above, where the sides are convex, apex blunt,

suture slightly impressed. Whorls 6½-7, slightly convex, the last whorl ascending very little near the mouth. Aperture nearly vertical, semioval, obliquely truncated, with a strong re-entering bifid palatal plait on the callus uniting the margins of the peristome, a spiral columellar lamina commencing at a distance within the mouth, and four tubercular teeth just inside the peristome.—one columellar, two joined together at their base, at the lowest part of the aperture, and one, very small, inside the right margin and opposite to the large parietal plait. Peristome white, slightly expanded, except near the junction with the last whorl, where the margin is slightly curved back. Length 0.18, diameter 0.06, length of aperture 0.04 inch.

This form, of which I have received four specimens from Col. Beddome, is distinguished from its allies by being quite smooth. As in the case of some of the allied forms, it is not improbable that in old specimens the peristome may be more broadly expanded and the palatal teeth maybecome more or less obsolete.

21. Ennea stenostoma, Bedd. MS., Plate II, Fig. 17.

Testa longe profundeque rimata, pupiformis, cylindraceo-ovata, solidula, lævigata (forsan aliquando oblique striata), impolita, haud nitida, albida. Spira subcylindrica, lateribus convexiusculis, apice rotundato, obtuso, sutura impressa. Anfr. 6½, convexi, quatuor penultimi subæquales; ultimus post aperturam valde compressus, haud ascendens, capillaceo-striatus, lateribus ambobus juxta peristoma scrobiculis impressis constrictus. Apertura verticalis, subaxialis, non lateralis, suboblonga, altior quam lata, marginibus lateralibus concaviusculis, basali convexo, dentibus valde coarctata, plica una valida simplici intrante parietali juxta angulum, tuberculis duobus columellaribus, uno superiore profundo, alio majore inferiore in peristomate, duobus minoribus basalibus, uno dextrali, alio sinistrali, uno denique majore bifido in margine dextro, plicæ parietali opposito sed inferiore, munita. Peristoma album, reflexum, postice sinuatum, marginibus callo lamellifero junctis. Long. 3½, diam. 1½, ap. long. 1½ mm.

HAB. In montibus 'Golconda' dictis, haud procul ab urbe Vizagapatam (H. Beddome).

Var. minor, anfractibus 5½; long. 3, diam. 1½, ap. long. 1½ mm. (Pl. II, Fig. 16.)

HAB. In montibus haud procul ab urbe Karnul (Kurnool) Indiæ meridionalis, (H. Beddome).

None of the teeth are well represented in the figure.

Shell with a long deep groove at the base, pupiform or cylindrically ovate, rather thick, smooth (perhaps sometimes obliquely striated), dull, destitute of polish, whitish. Spire subcylindrical, with the sides slightly convex, the apex blunt and rounded, and the suture impressed. Whorls 61, convex the four behind the last whorl subequal, the penultimate being scarcely smaller; the last strongly compressed behind the aperture, with raised hair-like lines of sculpture, not ascending, deeply indented on both sides. Aperture* vertical, nearly in the axis of the shell, not lateral, nearly oblong in shape, higher than broad, both the right and left margins slightly concave, lower margin convex. Teeth in the mouth numerous, and consisting of the simplet strong re-entering parietal fold near the posterior angle, two columellar tubercles (the upper and smaller situated at some depth inside the mouth, the smaller and larger in front close to the lip), two small basal teeth right and left of the lowest portion of the mouth, and one large bifid tooth on the right margin nearly opposite to the parietal fold, but not very close to it, and rather inferior to it in position. Peristome white, expanded throughout, curved back near the posterior angle, the margins united by a thick callus, on which the parietal lamina Length 0.14, diameter 0.06, length of aperture 0.05 inch. is situated.

The typical form was obtained in the Golconda hills near Vizagapatam, and the single specimen sent to me by Col. Beddome, from which the accompanying figure was taken, was broken after being drawn. The description is from a specimen in the British Museum.

A smaller variety with 5½ whorls, and measuring 0·12 inch in length, 0·06 in diameter, and 0·37 in length of aperture, was procured by the same naturalist in the hills near Kurnool.

I have received three specimens of this variety from Colonel Beddome, and there are others in the British Museum. All have the same dull weathered appearance, though they look fairly fresh; but on one there appear what may be traces of sculpture, apparently striæ similar to the fine raised lines occurring on the last whorl near the aperture in all.

I am not acquainted with any species of *Ennea* nearly allied to this species. In form, the Sikkim and Khasi *E. stenopylis* shows some resemblance; but that shell is strongly costulate, and its curious aperture, with the posterior portion almost cut off and forming a semi-detached tube, shows the species to be merely an ovate form of the Himalayan and Burmese group, comprising *E. vara*, *E. blanfordiana*, and *E. cylindrelloidea*.

It is too broad in figure 17, and the shape is incorrect. The teeth, however, are nearly correct.

[†] Erroneously represented as double in fig. 17 on the accompanying plate.

22. Ennea beddomei, sp. nov.

Testa rimata, subcylindraceo-turrita, cereo-albida, nitida, confertim verticaliter costulata, costulis in anfractu ultimo plus minusve obsoletis. Spira elongata, sursum attenuata, apice obtuso, sutură impressă. Anfr. 6, convexi, ultimus antice ad aperturam vix ascendens. Apertura fere verticalis, semielliptica, lamellis duobus validis parietalibus, ună anteriore dextrali intrante intus tortă, aliă profundă sinistrali subcolumellari incurvă, dentibusque lamelliformibus minoribus duobus vel tribus profundis palalalibus coarctata. Peristoma albidum, expansum, postice juxta angulum leviter sinuatum, marginibus callo lamellifero junctis. Long. 3½, diam. 1½, ap. long. 4 mm.

HAB. In montibus 'Sivagiri' dictis (Tinnevelley) Indise meridionalis (H. Beddome).

Shell rimate, subcylindrically turreted, pale yellowish white, polished, with close vertical ribbing on all the whorls, the ribs being more or less flattened and obsolete on the last. Spire elongate, becoming more slender above, apex blunt, suture impressed. Whorls 6, convex, the last scarcely ascending in front at the mouth. Aperture nearly vertical, semi-elliptical, with two strong re-entering parietal lamellæ—one of them in front to the right near the angle of the mouth, slightly twisted inside, the other to the left near the columellar margin, commencing at a distance within the mouth, and curved; there are also two or three small depressed lamelliform palatal teeth; but they are seen with difficulty from the front. Peristome white, expanded, the margins united by a callus bearing the parietal folds, the right margin curved back near the angle. Length 0.15, diam. 0.05, length of aperture 0.025 inch.

I have named this shell after the discoverer instead of adopting the term he had given to it in MS., as the latter might be objected to and changed. I have no specimen myself at present, but there are four in the British Museum. The form is peculiarly distinguished by the absence of any teeth in the peristome itself, although there are two or three at a little distance inside the aperture, and two folds on the callus joining the margins of the lip. In general form there is some resemblance to $E.\ exilis.$

23. ENNEA CANABICA, Beddome, MS.

Testa rimata, turrita, albida, solidula, confertim verticaliter costata. Spira subregulariter attenuata, apice obtuso, sutură profundiusculă. Anfr. 5\frac{1}{2}, convezi, infra saturam inflati, gradatim crescentes, ultimus antice viz ascendens. Apertura subrotunda, superne truncata, lamellă validă parietali intrante subtortă, partem posteriorem aperturae fere discernente, alidque

columellari profunda, vix in fauce conspicua, coarctata; dentibus palatalibus in peristomate nullis. Peristoma continuum, longe adnatum, album, incrassato-patens, undique expansum, intus granulatum, margine columellari angulatim incisum, basali lato, dextrali intus juxta lamellam parietalem breviter projiciente, angulum versus leviter retro-sinuatum. Long. 83, diam. 2, ap. intus 3 mm. alta.

HAB. In provincia 'South Canara' ad latus occidentale Indiæ meridionalis (H. Beddome).

Shell rimate, turreted, white (fresher specimens are probably yellowish white and polished), all the whorls ornamented with close vertical ribs. Spire almost regularly attenuate, apex blunt, suture rather deep. Whorls 6½, convex, swollen, and projecting beneath the suture, increasing in size by degrees, the last not ascending near the mouth. Aperture nearly round, except above, with one strongly developed parietal lamella, commencing in the front and re-entering deeply, a little twisted within, and so large as almost to cut off the upper left or posterior portion of the aperture; another smaller, deep-seated columellar fold is scarcely discernible from the mouth; no palatal teeth. Peristome continuous, attached for a considerable distance to the last whorl, white, thickened, broadly expanded, granulate inside; the columellar margin with an angular incision, the basal margin broader than the others, right margin curved back near the angle, and having a blunt projecting tooth-like process inside, opposite the parietal fold. Length 0.15, diameter 0.08, length of aperture within 0.025 inch.

The above description is taken from the only specimen I have ever seen, which is in the British Museum. The shell is remarkable for its peculiarly shaped whorls, each of which is suddenly swollen below the suture, so as to give almost a step-like appearance to the spire. The rounded mouth, too, with the broadly expanded peristome is quite different from that of any other Indian form of the genus. Perhaps the Khasi-Hill Ennea vara is as closely connected as any of the South-Indian forms, though there is but little resemblance between it and the present species, except such as is due to both being strongly ribbed, and to the manner in which the posterior or upper right-hand corner of the mouth is almost isolated by the strong parietal lamella and a projection from the inner margin of the peristome.

24. HELIX CALPIS.

Bens., Ann. & Mag. Nat. Hist. ser. 3, vol. iii, p. 268.—Pfr., Mon. Hel. v. p. 64.—Hanley, Conch. Ind. pl. xvi. fig. 8.

Macrochlamys calpis, Theobald, Cat. Land Freshwater Shells Brit. Ind. p. 19. 8 Nanina (Microcgetis) calpis, Nevill, Hand-list Moll. Ind. Mus. pt. i. p. 38.

This species was described from specimens collected by myself in 1856. I had but an imperfect knowledge of land mollusks at the time, or I should, I think, have seen at once, as I did some years afterwards, when re-examining my collections, that the shells were all young specimens of Raphaulus (Streptaulus) blanfordi. I had altogether a considerable number of specimens of the supposed Helix calpis; of these four were sent to England, and were examined by Mr. Benson; and it is manifest, from his description, that there was no difference between his examples and mine. In some of the latter I found the operculum still remaining.

In Mr. Nevill's Hand-list of Mollusca in the Indian Museum, Calcutta (l. c.), specimens of Nanina calpis from the Nága and Khási hills are included. Streptaulus blanfordi has been found in Sikkim, and in the Dafla hills, east of Bhutan; and I learn from Col. Godwin-Austen that he obtained a specimen from Brahmakúnd at the head of the Assam valley; but, as no example of the shell is known to have been found in the hillranges south of Assam, I think the specimens in the Indian Museum must be something different from the form described as Helix calpis by Mr. Benson.

25. SPIRACULUM TRAVANCORICUM, Beddome, MS., Plate III, Fig. 6.

Testa late umbilicata, depresso-turbinata, in exemplo vetusto adhuc detecto lævis, albescens (junior forsan epidermide induta, colorataque). Spira elevata, depresso-conica, sutura profunda, apice acuto. Anfr. 4½, rotundati, ultimus cylindraceus, aperturam versus descendens atque breviter solutus, 3 mill. pone aperturam tubulo longiusculo antrorsum directo, anfractum penultimum tangente, munitus. Apertura diagonalis, circularis; peristoma duplex, internum breviter porrectum, superne sinistrorsum leviter sinuatum, externum expansum, atque, nisi ad marginem sinistrum, undulatum. Operculum extus fere planum, marginibus anfractuum exteriorum liberis, intus concavum. Diam. maj. 12½, min. 10½, axis 7, diam. apert. 5½ mill.

HAB. In montibus Travancoricis haud procul a Tinnevelly (H. Beddome).

Shell broadly umbilicate, depressedly turbinate, and, in the single aged specimen found, decorticated, whitish and smooth throughout. Traces of a brown epidermis remain around the umbilicus, and younger specimens are probably brown in colour, and perhaps ornamented with coloured bands, like other species of the genus. Spire raised, depressedly conical, suture deep, apex acute. Whorls 4½, rounded; the last cylindrical, descending, and free near the aperture, and provided above, about three millimetres behind the mouth, with a rather elongate tube, which projects forward, and is in

contact with the penultimate whorl throughout. The tube appears broken at the end, and may have been even longer originally; the anterior termination in the specimen is in a line with the oblique peristome of the shell. Aperture diagonal, circular; peristome double, inner lip sharp, not projecting much, curved backwards near the penultimate whorl; outer peristome expanded, and wavy above externally and below, straight and somewhat narrower on the left margin. Operculum nearly flat externally, concave within; the outer margins of the whorls free and lamellar, except towards the middle; the circumference surrounded by several fine raised lines, the edges of the outermost whorls. Major diameter 0.5 inch, minor 0.42, axis 0.3, diameter of the mouth 0.23.

This species differs from all others of the genus by its higher spire, and by the combination of the mouth being free and the sutural tube being directed forwards and attached to the last whorl. The solitary specimen obtained was procured at a considerable elevation, 4000 or 5000 feet, in the hills between Travancore and Tinnevelly, not far from Cape Comorin.

26. CATAULUS COSTULATUS, sp. nov., Plate III, Fig. 7.

Testa subperforata, subovato-turrita, solida, subsinuate costulata, pallide straminea. Spira convexo-turrita, apice obtusiusculo, sutura valde impressa. Anfr. 7½, convexi, ultimus arctius convolutus, antice porrectus fere solutus, carina basali valida, compressa, costulata, antice dilatata munitus; periomphalo mediocri, costulato. Apertura subcircularis, fere verticalis, canali ad latus sinistrum marginis basalis patente, ore subobliquo, subtus spectante. Peristoma album, incrassato-expansum, revolutum, postice dextrorsum atque antice sinistrorsum ad canalem basalem productum, margine columellari angustiore, cum anfractu penultimo breviter juncto. Long. 16, diam. (perist. incl.) 5, diam. min. 5½, apert. intus 3 mm.

HAB. In montibus 'Tinnevelly Ghats' dictis Indiæ meridionalis, (H. Beddome).

Shell subperferate, subovately turreted, solid, rather coarsely and subsinuately costulated, of a pale straw-colour. Spire turreted, with convex sides, apex rather obtuse, sutures well impressed. Whorls 7½, convex, the last more closely wound than the penultimate, to which it is scarcely attached just behind the mouth; the basal keel compressed, costulate, dilated in front; the space inside the keel and around the umbilicus is of moderate size and ribbed. Aperture nearly circular and subvertical, with the opening of the basal canal on the left side of the base, and not quite in the same plane as the aperture, but turned rather downwards. Peristome white, thickened, expanded, and turned back, produced above to the right of the penultimate whorl and below around the canal, narrow on the columellar margin, and

only united for a short distance with the penultimate whorl. Length 0.65 inch, breadth (including the peristome) 0.25, minor diameter from front to back 0.23, width of aperture inside 0.13.

This species of Cataulus, the third hitherto obtained from the hills of Southern India, is distinguished from all other known forms of the genus by its comparatively coarse ribbing across the whorls. In other respects, it closely approaches C. calcadensis, Bedd. (J. A. S. B, 1869, xxxviii. pt. 2, p. 137, pl. xvi. fig. 8), having a similarly shaped spire, aperture, and basal channel. I have only seen one specimen of C. costulatus; this differs from C. calcadensis not only in having stronger sculpture, but also in being rather shorter and in having one whorl less in the spire. The colour of C. costulatus also is paler than that of the Calcad shell, and the lip of the aperture is white.

Like the other Southern-Indian forms, O. calcadensis, O. recurvatus, and the species hereafter described, O. costulatus has the canal a little to the left of the lowest portion of the aperture, or nearer to the umbilicus than to the outer margin. In most Ceylonese species of the genus, the canal is nearly at the lowest portion of the mouth.* I find that in O. tortuosus the position of the canal is precisely as in O. calcadensis and O. costulatus (in O. recurvatus, the sinistral position of the canal is much more marked).

27. CATAULUS ALBESCENS, Sp. nov.

Testa subperforata, subovato-turrita, tenuiuscula, albido-cornea, subsinuate costulato-striata. Spira turrita, lateribus convexis, apice obtusiusculo, sutura valde impressa. Anfr. 7, convexi, ultimus arctius convolutus, antice porrectus, fere solutus, vix descendens, carina basali transversim striata, postice obsoleta, antice valida, juxta aperturam dilatata munitus; periomphalo mediocri, plicato-striato. Apertura subcircularis, fere verticalis, canali ad latus sinistrum marginis basalis patente, ore antice spectante. Peristoma album, incrassato-reflexum, postice et ad canalem basalem productum, margine columellari angustiore, cum anfractu penultimo breviter junctum. Long. 18, diam. maj. 5½, min. 4½, apert. diam. intus vix 3 mm.

HAB. In montibus Travancoricis haud procul ab urbe Trevandrum.

Shell subperforate, subovately turreted, rather thin, whitish horny, rather sinuately and costulately striated. Spire turreted, with the sides convex, apex obtuse, suture much impressed. Whorls 7, convex, the last more closely wound than the penultimate, to which it is but slightly attached just behind the mouth. Basal keel transversely striated, subobsolete on the body-whorl near the junction of the peristome, becoming stronger in

[•] It is slightly to the left in C. pyramidatus, C. curytrema, and C. austenianus; basal in the smaller forms, like C. templemanni and C. layardi.

front and dilated near the mouth; the space inside the keel and around the umbilicus is of moderate size and plicately striated. Aperture nearly circular and subvertical, with the opening of the basal canal to the left of the base, and in nearly the same plane as the aperture. Peristome white, thickened, expanded and turned back, produced slightly above to the right of the penultimate whorl, and to a greater extent below at the mouth of the canal; columellar margin a little narrower, joined for a short distance only to the penultimate whorl. Length 0.53, major diameter 0.22, minor 0.18; breadth of the aperture within 0.12 inch.

This is the smallest form yet obtained of the peculiar group of Southern-Indian Catauli. I received three specimens some years ago from Mr. Theobald, who supposed them to be C. calcadensis. Mr. Theobald, I believe, procured them from Mr. F. W. Bourdillon, who obtained them near Mynall, on the hills east of Trevandrum. This shell is, I think, mentioned as Cataulus calcadensis by Mr. Theobald in his description of Mr. Bourdillon's shells (J. A. S. B., 1876, xlv. p. 185). The present species, however, has one whorl less, and is a much smaller shell, with proportionately shorter whorls, the sculpture is less close and distinct, the colour whitish instead of golden brown, the basal keel less developed, and its opening is in the same plane as the aperture, instead of being turned downwards, &c. From C. costulatus, the present form is chiefly distinguished by its much finer sculpture and by the characters of the basal keel.

28. CATAULUS CALCADENSIS.

The original specimens of this species described by me in 1869 (J. A. S. B., xxxviii. pt. 2, p. 137) were bleached and chalky. Subsequently, Col. Beddome, who discovered and named this very interesting form of Cataulus, procured fresh living specimens of a golden-brown colour, with the aperture of the same tint as the shell. The peristome in these specimens is not free from the last whorl. The operculum is normal, and precisely similar to that of Ceylonese species of the genus.

The specimens described by Mr. Theobald as Hapalus travankoricus† are, I am satisfied, immature shells, and I believe them to be the young of this, of O. albescens, or of some nearly allied species of Cataulus. Mr. Theobald states that the types of his supposed Hapalus differ from the young of Cataulus calcadensis, i. e., C. albescens, but he omits to point out the distinction. I had an opportunity of examining the types, which were

[•] I have not seen specimens of the olive colour represented in the 'Conchologia Indica,' pl. cvi, fig. 10.

[†] J. A. S. B. 1876, xlv. pt. 2, p. 186, pl. xiv. fig. 5. The name should, in any case, be Latinized as *travancoricus*. There is no such place as Travankor, the common English name Travancore being a corruption of the real name.

shown to me by Mr. Theobald, and I told him my views on the subject, but he did not agree with me.

I have recently examined the specimen of *O. tortuosus* (two in number) at the British Museum, and find the views I expressed several years since (J. A. S. B., 1869, xxxviii. pt. 2, p. 138) as to its alliance to *O. calcadensis* fully confirmed. In form, *C. tortuosus*, *O. calcadensis*, *C. costulatus*, and *O. albescens* are closely allied, all being much more ovate than any of the other species of the genus. The sculpture on *O. tortuosus* is much finer than on *C. calcadensis*, or even than on *C. albescens*. The discovery of two additional forms of this section of the genus in the hills of Southern India, and the absence of the genus from the collections hitherto made in the Nicobar Islands, tend to support the probability that *C. tortuosus* is also in reality a Southern-Indian form. Not a single *Cataulus* has hitherto been discovered in the Andaman Islands, in any of the countries to the east of the Bay of Bengal, or in the Malay Islands, so that the existence of the genus in the Nicobar Islands is extremely improbable.

29. REALIA (OMPHALOTEOPIS) ANDERSONI, sp. nov., Plate II, Fig. 18.

Testa perforata, ovato-conica, tenuiuscula, rufescenti-fulva, lævigata, parum nitida, oblique striatula. Spira conica, lateribus subrectis, apice acuto, sutura leviter impressa. Anfr. 7, planiusculi; ultimus ad peripheriam capillaceo-carinatus, subtus convexus, lævigatus, radiatim striatulus, carina circumumbilicari obtusa, fere obsoleta instructus. Apertura ovata, obliqua, fere diagonalis, spiram altitudine haud æquans. Peristoma obtusum, marginibus subconniventibus, callo tenui junctis, externo recto, basali expansiusculo, columellari subtus expanso, juxta perforationem emarginato, angulatim inciso. Operc.? Long. 7, diam. vix 5; ap. long. 31, lat. 21 mm.

HAB. In insulis Andamanicis (J. Anderson).

Shell perforate, ovately conical, thin, reddish brown in colour, smooth, not polished, obliquely striated. Spire conical, with sides nearly straight, apex acute, suture slightly impressed. Whorls 7, rather flat; the last with a hair-like keel at the periphery (the keel sometimes appearing on the upper whorls just above the suture), convex, smooth, and radiately striated below, and furnished with an obtuse, subobsolete keel around the umbilicus, the space inside the umbilical keel being smooth, not ribbed. Aperture ovate, oblique, nearly diagonal, a little shorter than the spire. Peristome obtuse, the margins approaching each other, and joined by a thin callus; outer edge straight, basal expanded, columellar expanded below, but emarginate and cut away into a re-entering angle near the perforation. Length 0.29, diameter 0.19; length of aperture 0.13, breadth 0.11 inch.

This species closely resembles R. (O.) rubens of Mauritius in form, but differs in sculpture, the shape of the whorls, &c. The umbilical keel is but faintly marked. Several specimens were procured about ten years ago by Dr. J. Anderson, Superintendent of the Indian Museum, to whom I am indebted for the types. They were obtained, I believe, at some distance from the coast.

30. REALIA PALLIDA, sp. nov., Plate II, Fig. 19.

Testa perforata, ovato-conica, tenuis, albido-cornea, lævigata, nitidula, vix verticaliter striatula. Spira conica, apice acuto, suturd impressa. Anfr. 6, convexiusculi; ultimus ad peripheriam atque subtus rotundatus, circa perforationem radiatim striatus. Apertura fere verticalis, ovata, spiram altitudine haud æquans. Peristoma tenue, marginibus subconniventibus, callo tenui junctis, externo recto, columellari expansiusculo. Operc.? Long. 4½, diam. 3; ap. long vix 2, lat. 1½ mm.

HAB. In insulis Andamanicis cum præcedente (J. Anderson).

Shell perforate, ovately conical, thin, whitish horny, smooth, moderately polished, with faint subobsolete vertical striation. (There is also, beneath the lens, a faint indication of minute spiral striation, but I am not sure that this is not an individual peculiarity.) Spire conical, apex acute, suture impressed. Whorls 6, slightly convex, the last rounded at the periphery and below, radiately striated around the perforation. Aperture nearly vertical, ovate, shorter than spire. Peristome thin, margins approaching each other, joined by a thin callus; the outer lip simple, the columellar slightly expanded. Length 0.17, diameter 0.12, length of aperture 0.075, breadth 0.06 inch.

I have but a single specimen of this species, which wants both the keels of the last species, and differs besides in size, colour, and sculpture. The specimen is perhaps not quite adult, but there can, I think, be no question of its being a peculiar form.

Neither of the two species above described can be confounded with the globose E. (O.) distermina (Benson, Ann. & Mag. N. H. Dec. 1863; Pfeif., Mon. Pneum. Suppl. ii. p. 178) with its costulate striation near the suture and inside the umbilicus, its rounded whorls, and its aperture equal in length to the spire. A glance at the figure of this shell in the 'Conchologia Indica,' pl. clxv. fig. 10, will suffice to show how different it is from either E. andersoni or E. pallida. Even if, as is possible, Benson's type was a young shell, it was manifestly a very distinct species, and the adult would probably resemble E alia (Omphalotropis) globosa of Mauritius in shape.

31. REALIA DECUSSATA, sp. nov.

Testa perforata, ovato-conica, tenuiuscula, striis obliquis incrementi, aliisque spiralibus, minutis, sublente subtilissime decussata, in anfractibus superioribus, nisi duobus supremis, undique, atque in inferioribus et supra et infra suturam costulato-striata, pallide rufescenti-fulva, anfractu ultimo cingulo pallido circumdato. Spira conica, apice acuto, sutura impressa-Anfr. 6, convexi; ultimus ad peripheriam rotundatus, subtus convexus, radiatim striatus, in umbilico costulato-striatus, lined impressa basali in loco carinæ circum umbilicum instructus. Apertura obliqua, rotundato-ovata, \$\frac{1}{2}\line{longitudinis}\text{ subæquans. Peristoma tenue, marginibus subconniventibus, callo tenui junctis, externo basalique rectis, columellari subtus expansiusculo, juxta perforationem retrosinuato. Opero. \$?\$ Long. \$3\frac{3}{4}\text{, diam. }2\frac{3}{4}\text{; ap. long. }1\frac{3}{4}\text{, lat. }1\frac{1}{3}\text{ mm.}

HAB. Cum præcedentibus in insulis Andamanicis (J. Anderson).

Shell perforate, ovately conical, rather thin, finely marked with oblique strike of growth and minute decussating spiral lines (only visible beneath the lens), costulately striated on the upper whorls (except the two uppermost) and close to the suture on the lower whorls, pale rufescent brown, with a pale band round the body whorl. Spire conical, apex sharp, suture impressed. Whorls 6, convex; the last rounded at the periphery and below, radiately striated beneath, more strongly in the umbilicus, and having an impressed line at the base around the umbilicus in the place of a keel. Aperture oblique, oval, but little higher than broad, about \$\frac{2}{3}\$ of the length. Peristome thin, the margins approaching each other and united by a thin callus; the outer and basal edges simple, columellar margin slightly expanded below, curved back into a shallow re-entering sinus close to the perforation. Length 0.15, diameter 0.11; length of aperture 0.07, breadth 0.06 inch.

This shell is distinguished by its fine decussated striation. I have but a single specimen, received from Dr. J. Anderson, with the others. Unfortunately no figure has been given, as I did not observe the distinction until after the accompanying plate had been drawn. Independently of sculpture, the species may be distinguished from O. distermina by its less globose form, and by the absence of the keel around the periphery; from R. andersoni by its much smaller size, more rounded whorls, and by the absence of the keel; and from R. pallida by rounder whorls, by colour, and by its rather more turreted form.

There is thus evidence of four different forms of *Realia* in the Andaman Islands. The genus is absolutely unknown in either India or Burma, the species of *Omphalotropis* (O. aurantiaca) once reported from

Pondicherry being really from the island of Mauritius;* and it is uncertain that the forms reported from Cochin China, Siam, and Singapore are not Assiminea. It is remarkable that the genus is almost entirely insular in its known distribution, and that it is especially common in the Mascarene Islands and in Polynesia.

32. PALUDOMUS TRAVANCORICA, Beddome, MS., Plate II, fig. 22.

Testa imperforata, ovato-conica, solidula, epidermide fuscă induta, sub epidermide albida, fasciis fusco-purpureis flexuosis verticalibus ornata, costis spiralibus subconfertis circumdata, interspatiis glabris, striis incrementi inconspicuis. Spira conica, subturrita, apice eroso, sutură impressă. Anfr. superst. 3, convexi, ultimus dimidium testæ superans. Apertura subverticalis, ovata, postice angulata, intus cærulescenti-albida, strigis flexuosis confertis conspicuis. Peristoma rectum, margine externo acuto, columellari basalique albis, intus incrassatis, dilatatis. Operc. normale. Diam maj. 16, min. 13½, alt. 23 mm. (apiee non eroso ad 25); apert. 12 mm. longa, 9 lata.

HAB. In Travancore (H. Beddome).

Shell imperforate, ovately conical, rather thick, covered with a darkbrown epidermis; beneath the epidermis white, with narrow vertical, very wavy dark purple stripes; all the whorls spirally ribbed, the ribs rather close together, with the interspaces smooth, the striæ of growth being inconspicuous. Spire conical, apex eroded (doubtless acute when perfect), suture impressed. Whorls remaining 3 (probably in the perfect shell 5 or 6), convex, the last exceeding half the length of the shell. Aperture nearly vertical, ovate, angulate at the posterior extremity, bluish white, with conspicuous, close, vertical, wavy, deep purple bands within; peristome in one plane, the external margin sharp, the columellar and basal margins white, thickened within, and dilated. Operculum normal. Major diameter 0 65 inch, minor 0.52, height (apex wanting) 0.9 (when perfect about an inch); aperture 0.5 high, 0.36 broad.

In a young specimen of *P. travancorica*, there appears to be a tendency to the development of minor parallel ribs between those forming the spiral sculpture, and the latter are rather closer together near the suture.

[•] See Benson, A. M. N. H. Sept. 1851, Ser. II, Vol. 8. p. 194.—Nevill, Handlist Moll. I. M. pt. i, p. 320. Hanley, Conch. Ind. Systematic list of Species, p. xiii, note 1, whilst pointing out that the species is not Indian, states that it occurs in the Isle of Bourbon. As he does not give his authority, the name of the island may have been inserted by mistake for that of Mauritius, but it is possible that the form occurs, like O. rubons and two or three other species, in both islands.

This fine and well-marked from of Paludomus was procured by Colonel Beddome in streams traversing the plains between Trevandrum and the foot of the Aghastyamali hill.

So far as I am aware, none of the forms of true Paludomus hitherto described from Southern India and Ceylon have the marked spiral sulcation of the present species. There is, however, a remarkable resemblance to the Ceylonese Philopotamis sulcata, the shell of which is only distinguished by wanting the conspicuous coloured bands within the peristome, although the operculum is very different. Perhaps the nearest ally of P. travancorica is the Burmese P. regulata; but that is a less conical form, and differs both in sculpture and coloration, as may be seen by comparing the figure of the present species with that of P. regulata in the 'Conchologia Indica' (pl. cviii. fig. 5). In form, P. travancorica has some resemblance to the common P. tanjorica* (Helix tanshaurica, Gmelin, Syst. Nat. p. 3655).

BYTHINIA EVEZARDI. 33.

Testa anguste umbilicata, ovato-conica, solida, striis regularibus spiraliter circumdata, albido-cornea, epidermide crassa olivacea obtecta. Spira conica, apice eroso, sutura valde impressa. Anfr. superst. 3 (in testa integra 4-5), convexi, ultimus dimidiam longitudinis subæquans, modice ventricosus, subtus circa umbilicum angulatim compressus, umbilico conico, intus lævigato. Apertura subverticalis ovata, antice atque postice subanqulata; peristoma simplex, rectum, obtusum. Operculum normale. Long. 31. diam. maj. 3\frac{1}{3}, min. 2 mm.; apert. intus fere 2 longa, 1\frac{1}{3} lata.

HAB. Ad Lanowlee (Lanaoli) juxta viam ferratum inter Bombay et Poona (G. Evezard).

Shell narrowly umbilicate, ovately conical, solid, surrounded by regular spiral impressed lines rather close together, whitish horny, covered with an Spire conical, apex eroded, suture deeply impressed. olive epidermis. Whorls remaining 3 (in a perfect shell about 4 to 5), rounded, the last about half the whole length, moderately ventricose, angulately compressed at the base around the umbilicus, which is conical and smooth inside. Aperture nearly vertical, oval, subangulate in front at the base and at the posterior extremity; peristome simple, straight, obtuse; operculum normal. Length 0.15, major diameter 0.13, minor 0.08 inch; aperture within 0.07 long, 0.05 broad.

This peculiar little species, distinguished by its distinct umbilicus from all other Indian forms, was obtained by Colonel G. Evezard at Lanaoli, a station on the railway from Bombay to Poona, situated a few miles east

of Khandalla at the top of the Bor-ghat.

· I think it is to be regretted that Gmelin's spelling should be adopted for this species, as the derivation of the name is thereby rendered obscure.

35. CREMNOCONCHUS FAIRBANKI.

"Cremnoconchus fairbanki, Blanford," Hanley, Conch. Ind. p. 58, pl. cxlvi, fig. 7.

I have described the species here attributed to me, and I greatly doubt my being responsible for the specific name, even in manuscript. I find amongst my collection a small box of *C. carinatus*, labelled *C. fairbanki*, but I cannot recollect whence the name was derived. The shell figured in the 'Conchologia Indica' resembles *C. carinatus* in form, but the angulation of the last whorl is not shewn, and the coloured bands represented are not, so far as I know, found in that species.

The shell figured in the same plate of the 'Conchologia Indica' (pl. exlvi, fig. 10) as *C. carinatus*, is certainly not that species, but *C. conicus*, var. Some of the references in the letterpress, p. 58, to my descriptions and figures of *Cremnoconchus* (J. A. S. B. 1870, xxxix, pt. 2, pp. 10—12, pl. 3, figs. 3, 4, 5) are incorrect.

36. CORBICULA IRAVADICA.

"Cor. iravadica, Blanf. MSS." Hanley, Conch. Ind. p. 62, pl. clv, fig. 8.

Testa fere æquilateralis, rhomboideo-ovata, ventricosa, solidiuscula, concentrice striata atque costulis subremotis, interdum plus minusve obsoletis, ornata, epidermide olivaced induta, intus violacea: latere antico ante umbones prominentes subhorizontali, tunc fere regulariter convexo, postico declivi, oblique subtruncatulo, demum subangulato, margine ventrali modice arcuato; ligamento postice subito contracto. Lat. 10½ mm., long. 9, crass. 7. In alio exemplo long. 11½, lat. 8½, crass. 7.

HAB. Ad Mandelay, urbem capitalem regni Avæ.

Shell nearly æquivalve, rhomboidally ovate, ventricose, thickish, concentrically striated and ornamented with ribs rather wide apart often more or less obsolete. The colour of the epidermis is olive, that of the shell inside violet. Anterior side nearly horizontal in front of the prominent umbones, then almost regularly convex, the posterior side slopes away gently at first, then sharply, almost as if truncated, and forms a rounded angle with the ventral margin, which is gently arcuate. The ligament behind is suddenly contracted and compressed, the hindermost portion, about a quarter of the length being very much smaller than the rest.

Dimensions of one specimen:—length 0.42 inch, breadth from umbones to ventral margin 0.36, thickness 0.28, of another much longer shell, the same measurements are 0.46, 0.34, and 0.28 inch.

It is very possible that this may not be separable from some of the numerous other forms of the genus, but I can find none precisely agreeing. The form is more ventricose and the umbones more prominent than in most

Indian Corbiculæ. The genus, like Unio, appears to have been designed by a beneficent Providence for the amusement of species-makers. the described local races in all probability pass more or less into each other.

EXPLANATION OF THE PLATES.

Plate II.

Fig. Euplecta vidua, var. minor, natural size.

This shell has not been described, the type having been mislaid, and one 4. figure, that shewing the shell from the mouth, omitted in the plate.

Euplecta vidua, typical form, natural size.

,, 8. Macrochlamys tenuicula, two views, natural size. In the left hand figure one whorl too many is represented, and in the right hand figure the peristome is represented as thick instead of very thin.

Macrochlamys platychlamys, two views, natural size. In the right hand view the lip should have been represented as very thin.

10. Streptaxis personatus, three views, enlarged two diameters, fair.

11. Streptaxis concinnus, three views, enlarged two diameters, teeth rather indistinct, otherwise good.

12. Streptaxis pronus, three views, enlarged two diameters, teeth not correctly represented; see description.

13. Streptaxis compressus, three views, enlarged four diameters; the teeth are incorrect, especially in the middle figure, where three are represented on the basal margin of the aperture instead of one only.

(Upper figure) Ennea subcostulata, enlarged four diameters. The columellar 14. tooth should be lower down.

- (Lower figure) Ennea exilia, enlarged four diameters. All the teeth are 14. wrongly represented; see description.
- Ennea macrodon, enlarged four diameters. The teeth in the peristome are 15. not distinct in the figure, and the large tooth inside the base is omitted altogether.

Ennea stenostoma, var., enlarged four diameters. Teeth not correct, they 16. should be precisely the same as in fig. 17.

Ennea stenostoma, typical form, enlarged four diameters. The mouth too broad, it should be of the same shape as in fig. 16. The teeth are correct.

Realia (Omphalotropis) andersoni, enlarged two diameters: fair figure. 18.

Realia pallida, enlarged two diameters, not good, the penultimate whorl 19. is by far too large, and the suture wrongly drawn.

Paludomus travancorica, natural size, good figure.

N. B. As already noticed in the text, several of the figures in this plate are unsatisfactory. In especial, the teeth in the aperture of some forms of *Ennea* and *Streptaxis* are by no means accurately represented. The plate having been twice lithographed, it appears hopeless at present to try to obtain greater accuracy. The general form of the shells is as a rule correct. The imperfection of the plate is partly due to its having been lithographed during the absence of the author of the present paper.

Plate III.

- Fig. 1. Hemiplecta tinostoma.
 - Hemiplecta enisa. " 3. Xestina albata.
 - " Ariophanta immerita. 4. ,,
 - Macrochlamys wynnei. "
 - Spiraculum travancoricum.
 - Cataulus costulatus.
- N. B. The figures on this plate are all fairly good; all are of the natural size except 76.

XXI.—List of Diurnal Lepidoptera from Port Blair, Andaman Islands, with Descriptions of some new or little-known Species and of a new Species of Hestia from Burmah.—By J. WOOD-MASON, Deputy Superintendent, Indian Museum, and L. DE NICE'VILLE.

(With Plate XIII.)

The first collection of Andamanese Lepidoptera of any importance was made by the native collector (Moti Ram) who accompanied Mr. Wood-Mason on his first visit to the Andaman Islands in the year 1872, and remained at Port Blair for some months after Mr. Wood-Mason's return to Calcutta, collecting insects in the immediate vicinity of the settlement. This collection was entrusted for determination and description in this Journal to the late Mr. W. S. Atkinson, who, however, only described in the 'Proceedings of the Zoological Society' two of the more obvious novelties, and eventually returned a few of the specimens to Mr. G. Nevill, who at that time had charge of the Museum collection of lepidopterous insects, and who placed them in the collection. These specimens are included in the present list.

Since 1872, numerous collections of Lepidoptera have been formed at Port Blair and at Kamorta in the Nicobars by the officers of the Port Blair establishment, and forwarded by them to England, where in 1877 Mr. F. Moore examined all the material that had been thus collected and drew up a complete list of "The Lepidopterous Fauna of the Andaman and Nicobar Islands," describing therein many new species and varieties both of butterflies and moths. In this list, 71 species of rhopalocerous Lepidoptera are recorded as inhabitants of the Andaman Islands. Since Mr. Moore's paper appeared, 4 new species and varieties of butterflies have been described by as many different authors, bringing up this number to 75. In the present list, 29 additional species, five of them described for the first time, are recorded, making a total of 104,—a number which might no doubt be largely increased by an experienced collector in a few weeks.

Several common species which occur everywhere in the neighbouring regions are not recorded, and these are all the more conspicuous by their absence from the circumstance that their supposed models are also absent; we allude to Hypolimnas misippus, Elymnias undularis, and the 2nd and 3rd forms of the female of Papilio polytes, which respectively mimick Danais chrysippus, Danais plexippus, Papilio hector, and Papilio aristolochiae. It is a curious fact that both in the Kulu valley and in the Simla district in the North-Western Himalayas, where Papilio hector and P. aristolachiae have never been found, the same forms of the female of Papilio

polytes are also absent: whether they are really absent from the Andaman Islands and the other regions mentioned, and, if so, whether they ceased to be developed or rather were exterminated as soon as the species spread into regions wherein neither of the forms which its females mimick exist, are interesting subjects for future enquiry.

Tribe PAPILIONES.

Family NYMPHALIDÆ. Subfamily DANAINÆ.

No representative of the genus Hestia has been received from Mr. de Roepstorff, but we are indebted to Capt. G. F. L. Marshall, R. E., for the gift of a specimen which that gentleman had received from Colonel Cadell, Chief Commissioner of the Andamans and Nicobars, but which does not agree with Felder's figure and description of Hestia agamarschana, the only species of the genus hitherto recorded from those islands, either in the extent and relations of the black markings or in the shape and proportions of the wings; the former being larger, more or less coalescent generally, and completely run together at the outer margin so as to form a distinct black border to each wing, and the posterior pair of the latter being broadly rounded off at the extremity and consequently not presenting the peculiar egg-shaped outline so characteristic of these organs in all the hitherto described Indian Hestias, e. g., H. Lynceus, H. Jasonia, etc., with the latter of which Felder compares his species; the specimen apparently also differs from H. agamarschana in having the white of all the wings everywhere more or less clouded with minute black scales. H. agamarschana, it is true, to judge from Felder's figure of it, has the posterior wings a little less pointed, the anterior discal spots on the anterior ones obviously more elongated, with more black in the cell and behind it, and the markings generally larger than in H. Jasonia, and it is, as might have been expected, more closely related to the specimen obtained by Col. Cadell than to any other species; but, large series of specimens having shown us how extremely constant the different species or local races of Hestia are, we cannot unite the two, and we think that the differences they present are in all probability due to a difference of station, and that Helfer may have obtained the specimen that served Felder for type on a different island; all the lepidopterous insects of late years received from the Andamans having been obtained in the immediate vicinity of the settlement at Port Blair, in an area therefore which is a very small fractional part indeed of the Andaman group of islands, which extends through nearly four degrees of latitude. We, therefore, propose to describe the specimen as a new species under the name of

1. HESTIA CADELLI, n. sp., Pl. XIII, Fig. 1, 3.

3. Allied to *Hestia agamarschana*, Felder. Wings above pure subpellucid white clouded, especially on the outer halves, with minute black scales, and marked and veined with intense black; all the markings larger, more or less coalescent, and blurred or paler at the margins, the veins more broadly black-bordered, and the marginal spots completely run together so that the wings are all, especially the posterior ones, distinctly bordered externally with black.

Anterior wings relatively narrower and longer, being more than twice as long as broad, with the discoidal cell equal in length to the submedian vein, that is to say, to the inner margin, and all but as long as the outer margin measured in a straight line from the extremity of the submedian vein to that of the subcostal; with the anterior discal spots more elongated and more completely coalesced, the spot between the first and second median veinlets alone constantly free, and the large rounded one internal to it in the same cell coalescent with the enlarged extremity of the cellular mark (which fills the cell nearly to the level of the origin of the second median veinlet, and is divided at the base of the wing by three indistinct longitudinal clouded white streaks), and the large mark in front of the submedian vein larger, triangular, and united by a black streak to the discal black spot beyond it.

Posterior wings shorter and broader, with the outer margin more broadly rounded off, the cell and the interspaces beyond it broader, the spot in it larger, and all those around it free, though exhibiting a tendency to coalesce with the black margins of the veinlets.

Wings below dirty-white of a dull opalescent tinge, with fuscousblack markings and veins.

Length of fore-wing 2:45; extreme length of discoidal cell, 1:38; expanse 5 inches.

HAB. Port Blair, S. Andaman.

We have much pleasure in naming this species after Colonel Cadell, Chief Commissioner of the Andamans and Nicobars, who obtained it, and who has shown himself no less ready than his predecessors to help those who are engaged in working out the interesting fauna of the islands under his charge.

Obs. The specimens of Hestia which Hewitson, in his list of Butter-flies from the Andamans (Ann. & Mag. Nat. Hist., ser. 4, vol. xiv, 1874, p. 356), considers to be specimens of H. agamarschana remarkable for their dark colour, doubtless belong here.

2. Danais melanoleuca.

Danais melanoleuca, Moore, Proc. Zool. Soc. Lond. 1877, p. 581, pl. lviii, fig. 3.

Numerous specimens of both sexes (A. de Roepstorff and Moti Ram).

3. EUPLEA CORE.

Papilio core, Cramer, Pap. Exot. 1782, vol. iii, pl. 266, figs. E, F.

Euplæa core, Butler, Journ Linn. Soc. Lond., Zoology, 1878, vol. xiv, p. 301.

One female (Moti Ram) agreeing with Bengal specimens.

4. EUPLŒA ANDAMANENSIS.

Euplæs andamanensis, Atkinson, Proc. Zool. Soc. Lond. 1873, p. 736, pl. lxiii, fig. 2, f. Butler, op. cit. p. 300.

Numerous males and females (A. de R. and Moti Ram).

This is one of the species described from the collection made by Moti Ram in 1872.

Subfamily SATYRINE.

5. LETHE EUROPA.

Pap. europa, Fabr. Syst. Entom. 1775, p. 500.

Males and females, all remarkably fine specimens.

6. MELANITIS LEDA.

Males and females (A. de R. and Moti Ram) and males of M. ismene, Cr.

7. MYCALESIS MINEUS, Linn.

" DRUSIA, Cr.

" BLASIUS, Fabr.

Males and females (A. de R. and Moti Ram).

8. MYCALESIS OTREA.

Pap. otrea, Cramer, Pap. Exot. 1782, vol. iv, pl. 314, figs. A, B.
—— francisca, Id., ibid., pl. 326, figs. E, F.
A female of one of the numerous varieties of this species.

8. MYCALESIS RADZA.

M. radza, Moore, Proc. Zool. Soc. Lond. 1877, p. 583, pl. lviii, fig. 2. One male and two females.

9. ELYMNIAS COTTONIS.

M. cottonis, Hewitson, Ann. Mag. Nat. Hist. 1874, ser. 4, vol. xiv, p. 358, & Q. Numerous males (A. de R. and Moti Ram); one female (A. de R.).

Subfamily Morphine.

10. DISCOPHORA CELINDE.

Pap. celinde, Stoll, Pap. Exot. Suppl. 1790, pl. 37, figs. 1, 1 A. One female.

Subfamily NYMPHALINE.

11. CETHOSIA NICOBARICA.

Felder, Verhand. zool.-bot. Gesellsch. Wien, 1862, vol. xii, p. 484; Novara Reise, Lep. p. 384, pl. xlviii, figs. 7, 8, 3.—Moore, Proc. Zool. Soc. Lond. 1877, p. 583, 2.

Two pairs (Moti Ram) and one male (A. de R.) agreeing perfectly with specimens from the Nicobars.

12. ATELLA ALCIPPE.

Pap. alcippe, Cramer, Pap. Exot. 1782, vol. iv, pl. 389, figs. G, H. Numerous specimens, male and female (A. de R. and Moti Ram).

18. CIBRHOCHBOA ANJIRA.

C. anjira, Moore, Proc. Zool. Soc. Lond. 1877, p. 584, 3 2. Males and females.

14. CYNTHIA EROTA.

Pap. erota, Fabr., Entom. Syst. 1793, vol. iii, p. 76. Numerous males and females.

15. Messaras erymanthis, var. nicobarica.

Felder, Verh. zool.-bot. Gesellsch. Wien, 1862, vol. xii, p. 486. Males and a female.

16. JUNONIA ŒNONE.

Pap. cenone, Linn., Cramer, Pap. Exot. 1775, vol. i, pl. 35, figs. A, B, C. Numerous males and females (A. de R. and Moti Ram).

17. JUNONIA ALMANA.

Pap: almana. Linn., Gramer, Pap. Exot. 1775, vol. i, pl. 58, figs. F, G. One pair.

18. JUNONIA ASTERIE.

Pap. asterie, Linn., Cramer, Pap. Exot. 1775, vol. i, pl. 58, figs. D, E. Three males and two females.

19. DOLESCHALLIA BISALTIDE.

Pap. bisaltide, Cramer, Pap. Exot. 1779, vol. ii, pl. 102, flgs. C, D.

Numerous fine specimens of both sexes. Specimens were also obtained by Moti Ram in 1872.

20. KALLIMA ALBOFASCIATA.

K. albofasciata, Moore, Proc. Zool. Soc. Lond. 1877, p. 584. Male and female.

21. EURYTELA HORSFIELDII.

Eurytela horesteldii, Boisduval, Faun. Ent. Madag, 1833, p. 54, f.

A single male.

22. CYRESTIS COCLES.

Pap. cocles, Fabr., Moore, Proc. Zool Soc. London, 1878, p. 829.
P. Cyrestis formosa, Felder, Reise Novara, Lep. p. 412, 3.

A single male of this delicately tinted butterfly.

23. CYRESTIS THYODAMAS.

Cyr. thyodamas, Boisd. in Cuv. R. A. 1836, Ins., pl. 138, fig. 4. Doubld. Westw. and Hew. Gen. D. L., pl. 32, fig. 3.

Amathusia ganescha, Koll. in Hügel's Kaschmir, 1848, vol. iv, p. 430, pl. 7, figs. 3, 4.

One male.

24. HYPOLIMNAS BOLINA.

Pap. bolina, Linn., Clerk's Icones, pl. 21.—Diadona bolina, Wallace, Trans. Ent. Soc. Lond. 1869, p. 278.

Numerous male and females (A. de R. and Moti Ram).

25. HERONA MARATHUS, VAI. ANDAMANA.

Herona marathus, Westw. Doubl. and Hew. Gen. D. Lep. 1850, p. 293, pl. 41, fig. 3.

andamana, Moore, Proc. Zool. Soc. Lond. 1877, p. 585, & Q.

Two males and a female.

26. PARTHENOS GAMBRISIUS.

Pap. gambrisius, Fabr.

Numerous specimens of each sex (A. de R. and Moti Ram).

27. NEPTIS MANANDA.

N. mananda, Moore, Proc. Zool. Soc. Lond. 1877, p. 586, pl. lviii, fig. 4, Q. Two pairs (A. de R. and Moti Ram).

Seems very near to N. khasiana.

28. NEPTIS ANDAMANA.

N. andamana, Moore, Proc. Zool. Soc. Lond. 1877, p. 586, 5 ?. Five males and a female (A. de R. and Moti Ram).

29. ATHYMA SELENOPHORA.

Limenitis selenophora, Koll. in Hügel's Kaschmir, 1848, vol. iv, p. 426, pl. vii, figs. 1, 2, 3.

A female, the only one in the Museum, was obtained by Moti Ram in 1872.

80. SYMPHEDRA TEUTA, VAR. TEUTOIDES.

S. teutoides, Moore, Proc. Zool. Soc. Lond. 1877, p. 586, & Q. Males and females (A. de R. and Moti Ram).

31. TANAECIA CIBARITIS.

Adolias cibaritis, Hewitson, Ann. & Mag. Nat. Hist. 1874, ser. 4, vol. xiv, p. 858; Exot. Butt. vol. v, Adolias, pl. iv, figs. 12, 13, 15, 3 2.

Tanaëcia cibaritis, Moore, Proc. Zool. Soc. Lond. 1877, p. 586.

Numerous males and females (A. de R. and Moti Pam).

82. TANAECIA ACONTIUS.

Adolias acontius, Hewitson, loc. cit. p. 857; Exot. Butt. vol. v, Adolias, pl. iv, fig. 11, Q. Tanaëcia acontius, Moore, Proc. Zool. Soc. Lond. 1877, p. 586.

One female.

83. LIMENITIS PROCEIS, VAR. ANARTA.

L. anarta, Moore, Proc. Zool. Soc. Lond. 1877, p. 585.

One female.

84. NYMPHALIS ATHAMAS.

Pap. athamas, Drury, Ill. Exot. Entom. 1773, vol. i, pl. ii, fig. 4.
One female.

Family ERYCINIDÆ.

35. ABISARA BIFASCIATA.

A. bifasciata, Moore, Proc. Zool. Soc. Lond. 1877, p. 587, pl. lviii, fig. 1, Q. Three females.

Family LYCÆNIDÆ.

36. LAMPIDES ARDATES.

Lycaena ardates, Moore, Proc. Zool. Soc. Lond. 1874, p. 574, pl. lxvii, fig. 1, &. One female.

37. LAMPIDES ÆLIANUS.

Hesp. aelianus, Fabr., Lycaena aelianus, Horsfield, Cat. Lep. E. I. Co., 1829, p. 78. One male.

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38. LAMPIDES ELPIS.

Polyomm. elpis, Godt., Encyclo. Méth. Ins. vol. ix, p. 654.—Lycaena elpis, Horsfield, opcit. p. 76, pl. 1, fig. 4, ? &.

One female and one male (A. de R and Moti Ram).

39. LAMPIDES PANDAVA.

Lycaena pandava, Horsfield, op. cit. p. 84, ?.
One female.

40. LAMPIDES conf. PACTOLUS.

Q. Wings above much as in *L. pactolus*, differing in having the dark fuscous outer border of the anterior wing spotless and that of the posterior wing very much less distinctly marked in the same manner, no discocellular mark in either wing, and the whole upperside apparently more clouded with smoky fuscous scales.

Wings beneath very pale fuscous, with a submarginal fascia composed of rhomboid spots and a marginal one of narrow oval spots fuscous of a rather darker shade than the ground, both margined and connected together by whitish, the latter of them developed, in the interval between the first and second median branches, into a conspicuous jet-black circular spot divided externally by a semicircle of pale blue metallic scales and encircled internally by luteous white, and into two minute ones, one on each side of the submedian vein, internally covered with blue scales.

Anterior wings with two small subcostal spots, a short discocellular fasciole, and a discal fascia strongly faulted at the second median veinlet so that the outer white margin of its posterior portion is in line with that of its anterior portion, and the inner white margin of its posterior portion in line with the discocellular veinlet.

Posterior wings with a similar discocellular fasciole, and complexly faulted and contorted discal and basal fasciæ; all the fasciæ in all the wings margined on both sides with fuscous of a very slightly deeper tint than the ground and with whitish.

Since the above description was written, we have discovered that five unnamed insects in the Museum from Cherrapunji in the Khasi Hills, the Sikkim Hills, and Sibsagar (S. E. Peal) in upper Assam are males of this species, and the following is a brief description of one of them:—

3. Wings above semitranslucent palish fuscous with a light and tolerably brilliant amethystine lustre, edged with a darker anteciliary line.

Wings below much as in the female, with the macular submarginal fuscous fascia of all the wings broader, and the anal and subanal black spots rather larger and conspicuously encircled with fulvous internally.

Length of anterior wing 9.72, 3.58—68; whence expanse = 9.5, 3.12—1.4 inches.

41. LAMPIDES PLUMBEOMICANS, n. sp.

Closely allied to the preceding, but much smaller; with three instead of two fasciæ on the underside of the anterior wings, with all the fasciæ relatively broader, and with those of the posterior wings much less complexly faulted and contorted.

3. Wings above dark amethyst-purple with a dull greyish leaden metallic lustre, with a deep black anteciliary line and fuscous fringe.

Wings beneath pale fuscous of a purplish tinge, with a marginal and a submarginal fascia composed of suboval spots of a darker shade than the ground, both margined and connected by whitish, the latter of them bearing in the posterior wings subanal and anal black spots in every respect as in the preceding except that the luteous inner line is rather more distinct.

Anterior wings with a basal fascia, a discocellular fasciole, and a discal fascia faulted as in the preceding at the second median veinlet; with the fasciæ as also the fasciole commencing at the costal vein where they are all broken.

Posterior wings with corresponding fasciole and fasciæ, which latter are more or less faulted at every vein though much less contorted and consequently more easily traced than in the preceding; fasciæ and fascioles of both wings margined on both sides with fuscous of a rather deeper shade than the ground and with whitish.

?. Wings above dull smoky.

Anterior wings with a pale discal patch which has a brilliant metallic pale bluish lustre in certain lights.

Posterior wings with a thin interrupted white line before the dark anteciliary one and a submarginal row of dark spots before it, spots and line increasing in size, breadth, and distinctness from the apical angle to the subanal region, the former obscurely encircled internally with smoky whitish.

Wings beneath lighter, with all the markings more pronounced, being margined with fuscous much darker than the ground and with pure white, and the marginal and submarginal macular fasciæ, especially conspicuous and coarse.

Length of anterior wing δ .56, δ .58, whence expanse = δ 1.12, δ 1.16 inches.

Two males and a female.

42. POLYOMMATUS SANGRA.

P. sangra, Moore, Proc. Zool. Soc. Lond. 1865, p. 772, pl. 41, fig. 8, 5.

Innumerable males and females. The commonest 'blue' in Calcutta, being obtainable in any number wherever there is a patch of grass.

43. APHNÆUS LOHITA, var. zoilus.

A. zoilus, Moore, Proc. Zool. Soc. Lond. 1877, p. 588, 3.

Q. Larger than the male. UPPERSIDE smoky brown, marked obscurely with darker bands corresponding to those of the underside. UNDERSIDE with the intervals between the hands wider owing to the greater breadth of the wings. In all other respects as in the male.

Length of fore-wing '7; whence expanse = 1.46 inches.

Males and one female.

44. HYPOLYCÆNA ERYLUS.

H. erylus (Godart), Hewitson, Ill. D. Lep. Lyc. p. 49, pl. xxi, fig. 1 3, 2, 4 2.

H. andamana, Moore, Proc. Zool. Soc. Lond. 1877, p. 589, & Q.

Three males and a female. Absolutely indistinguishable from fresh Sikkim specimens.

45. SITHON SUGRIVA, VAT. ARECA.

Amblypodia sugriva, Horsfield, Cat. Lep. E. I. Co. 1829, p. 105, pl. i, figs. 10, 10a, f. Myrina sugriva, Horsfield and Moore, Cat. Lep E. I. Co. p. 51, pl. 1a, fig. 12, f. Myrina areca, Felder, Verhand. zool.-bot. Gesellsch. Wien, 1862, vol. xii, p. 481, f.

Q. Smaller than the male. UPPERSIDE sepia-brown with a bronzy gloss, the spots and fascise of the underside scarcely showing through. Hindwing with a pure white patch divided by the brown veins, margined externally by a fine and sharp dark brown or black anteciliary line, and marked by a large circular black spot at the base of the tail on the anterior side and by another smaller lighter and less distinct one on the posterior side; with the caudal lobe blackish, and the tails black with pure white cilia. Underside pure white marked as in the male with dark sepia-brown fasciæ and spots, but with the black caudal spots larger and the cilia of the posterior part of the hind-wing pure white like those of the tails.

Length of fore-wing 66; whence expanse = 1.38 inches.

It differs from S. phocides Q (= S. jolcus (Felder), Hew., Ill D. Lep. Lyc. pl. xiii, figs. 16, 17) in the far less extent of the white patch on the upperside of the hind-wing, and in the larger size and darker colour of the spots and fasciæ, as well as in the greater pureness of the white, of the underside generally.

One male and one female, the former differing from a specimen from the Indian continent (Sylhet) only in its rather darker and more distinctly marked underside. The lighter apical portion of the fore-wing in the male has a beautiful bronzy gloss changing to dark purple according to the incidence of the light. Both the insular and continental specimen, but especially the former, present slight traces of the blue marginal band so conspicuous in the hind-wings of Javan and Ceylonese examples, in the shape of a small patch of metallic green scales on the anterior caudal lobe.

The male of this species, with its velvety black upperside, rich dark brown underside, and elongated hind-wings produced into long robust buff tails, presents a strong contrast to the dull-coloured female with her pure dazzling white underside conspicuously spotted and banded with dark brown, broader wings, and comparatively short and feeble white and black tails.

Sithon kamorta is not the female of S. sugriva, var. areca, as Felder has suggested, but that of a distinct though closely-allied species peculiar to the Nicobars, whence the Museum has recently received a specimen of the true male differing from S. kamorta just in the same way as S. sugriva does from its female, which appears not to have been previously described.

46. Sithon westermannii, var.

Dipeas westermannii, Felder, Reise Novara, Lep. p. 241, pl. xxx, figs. 21, 22, Q, from Luzon.

A male and a female, the latter differing from the former in having the upperside smoke-brown instead of purplish fuscous, no discal pale patch in the fore-wing, the hind-wing devoid of blue, and the underside ochraceous-brown instead of dark fawn colour with a vinous tinge. The male differs from the same sex of S. westermannii, in having less blue on the upper surface, and the anal spot completely encircled with grey scales.

A comparison of Andamanese with Philippine specimens would, we have no doubt, show that the former is just as much entitled to a name of its own as the latter. Both are merely insular races of the Indian continental S. jangala.

47. SITHON TARPINA.

Myrina tarpina, Hewitson, Ill. D. Lep. Lyc. Suppl. 1877, p. 23, pl. (Suppl.) iii a, figs. 93, 94, Q.

3. UPPERSIDE rich deep metallic violet-blue, with the anterior margin of the fore-wing narrowly, and the external margin of both wings more broadly and decreasingly bordered with black. UNDERSIDE with about the basal two-thirds of both wings corrulescent or virescent opaque dead white, the rich red-brown of the outer margins darker but similarly

banded and marked with white, and the orange spots smaller with a diffused patch of greyish white scales between them and two or three in front of them all somewhat confounded with the white marginal line.

Three specimens.

Length of forewing .84; whence expanse = 1.78 inches.

48. DEUDORIX EPIJARBAS.

Dipsas epijarbas, Moore, Cat. Lep E. I. Co. 1857, vol. i, p. 32, & Q. Deudorix epijarbas, Hew., Ill. D. Lep. Lyc. pl. vii, figs. 16, 18, &, 17, Q. Very numerous specimens of both sexes.

49. DEUDORIX DIENECES.

D. dieneces, Hewitson, Ill. D. Lep. Lyc. Suppl. 1878, p. 31, pl. v a, figs. 65, 67 &, 66 Q.

Males and females.

The Museum possesses males from Silhet and Calcutta also.

50. DEUDORIX ORSEIS.

D. orseis, Hewitson, Ill. D. Lep. Lyc. 1863, p. 23, 3.

Q. UPPERSIDE lighter, with a distinct purple gloss which has a light steel-bluish tint at the base of all the wings. UNDERSIDE lighter, with all the markings more distinct.

Length of fore-wing '68; whence expanse = 1.42 inches. Two males and two females.

51. DEUDORIX VARUNA.

Thecla varuna, Horsfield, Cat. Lep. E. I. Co. 1829, p. 91, 3 ?. A single male.

- 52. MYBINA ATYMNUS, VAR. PRABHA.

 Myrina prabha, Moore, Proc. Zool. Soc. Lond. 1877, p. 589, pl. lviii, fig. 5, Q.

 Males and female.

54. ARHOPALA CENTAURUS, VAR. CORUSCANS.

Pap. centaurus, Fabr. Ambly. centaurus, Horsf., Cat. Lep. E. I. Co. 1829, p. 102. Hewitson, Cat. Lyc. Brit. Mus. pl. ii, figs. 10-13, 3 2.

Male and female; the latter much smaller than the former. The bases of both wings in both sexes, but especially in the female, lighter,

with a greenish tinge, so that the whole central portion of the insects appears brilliantly illuminated by a pale greenish blue reflection in most lights.

55. SURENDRA QUERCETORUM, VAF. LATIMARGO.

8. latimargo, Moore, Proc. Zool. Soc. Lond. 1879, p. 142, 3 2.

A male and two females.

Is A. quercetorum itself more than a local race or variety of A. vivarna, Horsfield, Cat. Lep. E. I. Co. 1829, p. 99, from Java?

Family PAPILIONIDÆ.
Subfamily PIERINÆ.

56. TERIAS HECABE.

Pap. hecabe, Linn.

Males and a female.

57. TERIAS HARINA.

T. harina, Horsfield, Cat. Lep. E. I. Co. 1829, p. 137. Males and females.

58. HEBOMOIA ROEPSTORFFIL

H. Roepstorffi, Wood-Mason, antea, p. 134 &, et p. 150, Q.

"3. Differs from H. glaucippe, the only species of the genus with which I have been able to compare it, on the upperside, in having the apical orange patch of the fore-wing larger, extended into the cell, and less broadly bordered with fuscous, both internally and externally; the submarginal fuscous spots smaller and completely isolated from the fuscous of the outer margin; the fore-wing at the posterior angle tinged, and the hindwing externally broadly bordered, with bright sulphur-yellow, which colour is shaded off into the cream-colour of the rest of both wings; and the outer margin of the hind-wing narrowly edged with fuscous, which gradually broadens from the anal to the anterior angle and extends inwards in points at the veins:—and, on the underside, in having the brown mottling of the fore-wing arranged in the form of a tolerably conspicuous band coincident with the macular band of the upperside; and the ground-colour of the hind-wing, as also that of the mottled portion of the fore-wing, of a rich golden-luteous colour.

Length of fore-wing 1.76; whence expanse = 3 62 inches.

2. UPPERSIDE. Fore-wing with the orange patch devoid of amethystine gloss, externally more broadly bordered with fuscous (which at each veinlet gives off inwards an angular process the extremity of which is

continued on as a very narrow edging to each side of the veinlet), but internally much less distinctly so than in the male; with the cell more clouded with dark scales; and with the sulphur-colour at the inner angle more diffused. Hind-wing with a marginal row of large subtriangular fuscous spots placed upon the veinlets from the first subcostal to the first median (the two last obsolete), decreasing from the second in the direction of the anal angle, and connected together at the extreme margin of the wing by a narrow edging of the same colour, which extends to the anal angle; with a submarginal series of six roundish spots, similarly decreasing from the first, and alternating with those of the marginal series, each being placed upon a fold, the first and largest on the fold between the costa and the first branch of the subcostal, and the last on that between the first and second median veinlets; and with the sulphur-colour around the four intermediate submarginal spots stained with orange. Underside of both wings paler.

Length of fore-wing 1.7; whence expanse = 3.5 inches.

HAB. South Andaman.

In a specimen of the male from the collection of Captain G. F. L. Marshall, the submarginal fuscous spots of the fore-wing are obsolete.

The place of this species would seem to be between *H. vossii* (Maitland) and *H. sulphurea*, Wallace."

59. IXIAS ANDAMANA.

I. andamana, Moore, Proc. Zool. Soc. Lond. 1877, p. 590, & Q. Numerous males and females (A. de R. and Moti Ram).

60. CATOPSILIA CROCALE.

Pap. crocale, Cramer, Pap. Exct. 1779, vol. i, pl. lv, figs. C, D, Q. Callidryas crocale, Butler. Lep. Exot. 1869-74, p. 22, pl. ix, figs. 1, 2, 3, 6, & Q. Two males.

61. PIERIS NADINA, VAR. NAMA.

Pieris nadina, Lucas, in Guérin's Rev. et Mag. Zool. 1852, ser. 2, vol. iv, p. 333, f. P. nama, Moore, Proc. Zool. Soc. Lond. 1857, p. 102, pl. 44, figs. 1, 2, & Q. Hewitson, Ex. Butt. Pieridae, pl. 6, fig. 37.

Males and females.

62. Piebis coronis, var. Lichenosa.

Pap. coronis, Cramer, Pap. Exot. vol. i, 1776, pl. 44, figs. B, C. Pier. lichenosa, Moore, Proc. Zool. Soc. Lond. 1877, p. 591.

Two pairs.

63. ERONIA VALERIA, VAT. NARAKA.

Pap. valeria, Cramer, Pap. Exot. 1779, vol. i, pl. 85, fig. A, &. Eronia naraka, Moore, Proc. Zool. Soc. Lond. 1877, p. 591, & Q. Males and a female.

The Javan specimens of the male described by Horsfield and figured by Cramer both have the black outer border of the anterior as well as the posterior wings immaculate, and thus agree more closely with the S. Indian (var. pingasa), Ceylonese (var. ceylonica), and Andamanese (var. naraka) varieties. As might have been expected from its more northern station, the Andamanese more nearly approaches the north Indian form (var. gaea).

64. TACHYRIS PAULINA.

Pap. paulina, Cramer, Pap. Exot. vol. ii, pl. 110, figs. E, F, Q.

Pieris albina, Boisd., Sp. Gén. Lep. p. 480, &.

Tachyris paulina, Wallace, Trans. Ent. Soc. Lond. 1867, ser. 3, vol. iv, p. 369.

Two males and two (white) females differing in no respect from those of continental India (Naga Hills, Cachar, Bhutan, and Madras).

Tachyris galathea, Felder, is a perfectly distinct race peculiar to the Nicobars, whence we have specimens.

Subfamily PAPILIONINE.

65. OBNITHOPTERA HELIACONOIDES.

Ornith. heliconoides, Moore, Proc. Zool. Soc. Lond. 1877, p. 592, & Q.

A male and a female.

66. Papilio Charicles.

P. charicles, Hewitson, Ann. & Mag. Nat. Hist. 1874, ser. 4, vol. xiv, p. 356; Exot. Butt. vol. v, Pap. pl. xiv, fig. 45, Q.

One female of the 3rd form (Moti Ram).

This is the Andaman representative of the continental P. androgeus; it is interesting to find that it has acquired the red tails of its model, P. rhodifer, the slight Andamanese modification of the continental P. doubledayi.

67. PAPILIO MAYO.

P. mayo, Atkinson, Proc. Zool. Soc. Lond. 1873, p. 736, pl. lxiii, fig. 1, &.

Two males (A. de R. and Moti Ram). The species was described by Atkinson without acknowledgment from the specimens obtained by Moti Ram.

The Andamanese representative of the continental P. polymnestor.

68. Papilio polytes, var. nikobarus.

Felder, Verh. zool.-bot. Gesellsch. Wien, 1862, vol. xii, p. 483.

Males and females of the first form only (A. de R. and Moti Ram).

69. Papilio agamemnon.

Males and females (A. de R. and Moti Ram).

70. PAPILIO EURYPYLUS.

One pair.

71. Papilio clytia, var. flavolimbatus.

P. dissimilis, var. flavolimbatus, Oberthür, Etudes d'Entom. 4 me livr. p. 101, Q.

This variety agrees in the size and distinctness of the cretaceous white markings of the upperside best with specimens from Silhet, Sibsagar, and Burmah on the Indian mainland, but differs from them, as indeed it does from all specimens in the Museum, in the large amount of rich golden yellow at the outer margin on both sides of the posterior wings: the marginal and submarginal flavous spots seen at the anal angle of the wing in most continental specimens are in this case so completely run together on both sides as to have left only a small central spot of the black ground-colour that separates them from one another in continental specimens; they are succeeded by a series of six (incisural) marginal spots of the same colour; the submarginal lunules are much larger and more spear-shaped and, moreover, sullied with yellow, especially the one near the anal blotch: on the underside, the marginal golden yellow spots are larger and tend to coalesce with the hastate submarginal markings, which consequently are more suffused with yellow than they are on the upperside.

A single male.

72. Papilio læstrygonum.

- P. laestrygonum, Wood-Mason, Proc. Asiat. Soc. Bengal, June, 1880, p. 102, et antea, p. 178, pl. vi, fig. 1, 1a, 3.
 - P. epaminondas, Oberthür, Etudes d'Entom. 4 me livr. p. 62, pl. iv, fig. 1, 3.
- "&. Wings above cretaceous-white, the anterior ones black at the insertion, scarcely tinged with greenish at the base, with five black bands commencing at the anterior margin and cutting the cell, the first basal, extending to the inner margin, the second rather broader, also extending to the inner margin, and emitting a short conical process at the origin of the first median veinlet, the third scarcely broader, extending to the median vein, the fourth narrower, triangular, reaching or all but reaching the median vein, the fifth much the broadest of all, triangular, divided anteriorly into two forks by a curved narrow decreasing and interrupted band of the ground-colour running from the costal vein to the third median veinlet, extending to the inner margin, separated from the black outer marginal band by a band of the ground-colour divided by the black veins and very slightly if at all narrowing from the anterior margin up to the second median veinlet, whence it gradually decreases in width and distinctness to

the inner angle; all these black bands connected at the anterior margin, and the first, second, and fifth of them at the inner margin also, by a very narrow edging of black.

Posterior wings with two black bands commencing and connected at the anterior margin and coinciding with bands of the underside, one basal, extending to the end of the first half of the first median veinlet, and the other discal, extending a short distance into the space between the 2nd and 3rd median veinlets; with a small black spot near the end of the cell scarcely distinct from the discal band; with four discal spots immediately beyond the cell running nearly parallel with the band, the first and largest transversly elongated and coinciding with a spot on the underside, the rest smaller than the corresponding ones on the underside, which latter are consequently seen through the wing-membrane beyond the margins of the former; with a black spot succeeded by one of luteous at the anal angle; with a marginal and submarginal series of black lunules coalescent in the anterior third but more distinct in the posterior two-thirds of the wing. where the two series are more or less separated from one another by ashygrey scales continuous with the ashy patch occupying the outer third of the wing and extending also along so as to obscure the ultra-cellular part of the basal black band; with the discal band and spots more or less irrorated and obscured with ashy-grey scales so that the disk of the wing appears mottled with black and grey; and with the black tails, as also the incisures, margined with cretaceous-white.

Wings below pure white, anterior ones marked as above, with the ground-colour at the base and between the black bands as far as the median vein and its second branch yellowish; with the band of ground-colour separating the fifth black band from the black outer border distinct, and not decreasing but on the contrary rather increasing in breadth, to the inner angle; and with the curved line dividing the fifth black band into two forks more distinct and less discontinuous.

Posterior wings, from the base up to the median vein and the discal black band, yellowish, with three black bands, one narrow running from the insertion along the inner margin close to the abdominal fold, and two broader commencing and connected at the anterior margin and cutting the cell, one of these latter basal, extending nearly to the end of the basal half of the first median veinlet, and the other discal, some distance into the space between the 2nd and 3rd median veinlets, the two first of the three bands connected together at their outer extremities and with two largish coalescent black spots in the anal region; with a small black spot near the extremity of the cell, and six of the same colour immediately beyond it disposed in a line which runs straight from the costal vein as far as the cell, but then curves abruptly inwards, the first of these spots transversely

elongated, extending from vein to vein, and connected with the second, which is roundish and itself connected with the discal band, the third oval, about one-third the size of the second, and touching the discocellular veinlet, the fourth twice the size of the third, in contact with the median vein and its two last branches, the fifth rather smaller than the third, the sixth crescentic and connected with the two above-mentioned large spots in the anal region; with six large diffused luteous blotches externally margined with black, and increasing in size and depth of colour from the anterior to the inner margin; with the ground-colour between these blotches and the discal black spots pure white; with an increasing series of six marginal lunules, between which and the wavy black margins of the luteous blotches the ground-colour is white in the anterior and grey or greyish-white in the posterior portion of the wings; and with the incisures and the tails margined with lutescent.

Head black with two white frontal bands; pronotum with a luteous spot on each side; thorax above jet-black ornamented at the sides with long grey setæ, below cretaceous-white; abdomen cretaceous-white with a tapering dorsal black band and two lateral fuscous ones.

Length of anterior wing 1.7; whence expanse = 3.5 inches.

HAB. South Andaman. Two males.

To mark its close relationship to A. antiphates, I have called the species P. laestrygonum after the mythical people over whom Antiphates is supposed to have reigned. It differs from its nearest ally in having the upperside much blacker (the bands of the forewing being broader; the first, second, and fifth of them together with the marginal one extending to the inner margin, where they are all connected together by a very narrow black edging; and the disk of the hindwing mottled as it were by black and grey), a much greater extent of grey, and more highly developed marginal and submarginal lunules on the hindwing; in the abdomen being dorsally banded with black and the thorax ornamented with grey setæ, &c."

73. Papilio rhodifer.

P. rhodifer, Butler, Ent. Month. Mag., vol. xiii, 1876, p. 57. Five males.

Fam. HESPERIDÆ.

74. ISMENE CHROMUS.

Numerous examples (A. de R. and Moti Ram).

75. ISMENE ARIA.

Ismene aria, Moore, Proc. Zool. Soc. Lond., 1865, p. 784, & Q.—Hewitson, Exot. Butt., vol. iv, Hesp., pl. iii, figs. 24, 25, Q.

Male and female.

76. ISMENE LEBADEA.

Hesperia lebadea, Hewitson, Exot. Butt., 1868, vol. iv, Hesp. pl. iii, figs. 22, 23, &. One male.

77. ISMENE DRUNA.

I. druma, Moore, Proc. Zool. Soc. Lond. 1865, p. 784, ♂.—Hewitson, Exot. Butt. vol. iv, 1868, Hesp. pl. iii, fig. 26, ♂.

Two males.

78. TAGIADES RAVI.

Pterygospidea ravi, Moore, Proc. Zool. Soc. Lond. 1866, p. 779, & Q. One male and two females.

79. TAGIADES ALICA.

T. alica, Moore, Proc. Zool. Soc. Lond. 1877, p. 593, pl. lviii, fig. 11, &.

2. Above lighter, the dark markings consequently appearing more prominent.

The anterior wing has a minute transparent speck behind the three subapical ones, a very indistinct and small double whitish spot near the end of the cell on the upperside, and two discal whitish spots on the underside, the anterior one of which only is partially transparent and visible on the upperside.

The posterior wing is less white above and has the anal angle rounded as in T. obscurus.

Male and female.

80. PLESIONEURA ALYSOS.

P. alysos, Moore, Proc. Zool. Soc. Lond. 1865, p. 789.

Many specimens.

81. HESPERIA OCEIA.

H. oceia, Hewitson, Desc. Hesp. 1868, p. 31.

Males.

82. HESPERIA COLACA.

H. colaca, Moore, Proc. Zool. Soc. Lond. 1877, p. 594, pl. lviii, fig. 7, & Q. Two specimens.

83. HESPERIA CARTRA.

H. cabira, Moore, Proc. Zool. Soc. Lond. 1877, p. 593, pl. lviii, fig. 8, & Q. Males and females.

84. HALPE BETURIA.

Happeria beturia, Hewitson, Desc. Hesp. 1868, p. 36.

Halpe beturia, Moore, Proc. Zool. Soc. Lond. 1878, p. 690.

Males and one female. A pair from Calcutta in the Museum.

The number of spots in the forewing varies from 6 to 8.

85. HESPERIA CHAYA.

H. chaya, Moore, Proc. Zool. Soc. Lond. 1865, p. 791.
Male.

86. Telegonus thyrsis.

Telegonus thyrsis (Fabr.), Butler, Fabr. Lep. p. 262. Hesperia pandia, Moore, Proc. Zool. Soc. Lond. 1865, p. 790. Three males.

87. Pamphtla mæsoides.

P. massoidss, Butler, Trans. Linn. Soc. Lond., ser. 2, Zoology, vol. i, p. 554. Many specimens.

88. Pamphila Gola.

P. gola, Moore, Proc. Zool. Soc. Lond. 1877, p. 594, pl. lviii, fig. 9, &. Numerous specimens (A. de. R. and Moti Ram).

During the preparation of the foregoing list, we received from Bassein, on the mainland, two females of a species of *Hestia* of the same type as *H. cadelli*, in which the modifications of form and markings begun in *H. agamarschana* and continued in *H. cadelli* are carried to an extreme. These insects were obtained by Mr. Algernon Haden, who has generously presented one of them to the Museum, and after whom we have, consequently, all the more pleasure in naming the species

HESTIA HADENI, n. sp., Pl. XIII, Fig. 2, Q.

Q. Closely allied to H. cadelli. Wings above pure fleckless white marked and veined with black of a fuscous tint; with the marginal, submarginal, and all but the two posterior (which are subcoalescent with the marginal band) of the discal series of spots in the anterior wings, but with the marginal and submarginal series only in the posterior wings, completely run together so that only the inner portions of the outlines of the innermost series of the coalesced spots are in either case still discernible, and so as to form a very broad outer border of black to each of the wings.

Anterior wings broader and shorter, being less than twice as long as broad, the extreme length of the cell bearing the same relation to the submedian vein and to the less deeply emarginate outer margin; with the spot at the base of the second cell smaller and free of the veins, as also is the discoidal cellular spot at its posterior extremity; the curved club-shaped mark in the 3rd inner marginal cell much as in *H. agamarschana*, but not connected by a black streak with the snbcoalescent marginal spot beyond it; the outer black border with a clouded white spot in the second cell more or less distinctly separating the second discal black spot off from the band; and the black second inner marginal, or sutural, cell longitudinally streaked with clouded white.

Posterior wings broader, with their undulated outer margin still more broadly rounded; the spot in the discoidal cell smaller and the spots around it also rather smaller and free of the black outer border though exhibiting a tendency to coalesce with it in front of the second median veinlet.

Wings below of a less pure white than above, marked and veined with fuscous.

Thorax more conspicuously marked with greyish-white than in *H. cadelli*, in which these marks are almost effaced, but this character, as also the difference in the proportions, and the less obvious emargination of the outer margin, of the wings, may be sexual.

Length of anterior wing 2.54; extreme length of its discoidal cell 1.35; expanse 5.18 inches.

HAB. Bassein, Burmah. Two specimens agreeing in every respect with one another.

EXPLANATION OF PLATE XIII.

Fig. 1. Hestia cadelli, W.-M. & de N., J.

Fig. 2. Hestia hadeni, W.-M. & de N., Q.

calcaneo 0.18, cranii 0.028.

XXII.—Description of an Arvicola from the Punjab Himalayas.

By W. T. BLANFORD, F. R. S. ARVICOLA WYNNEI, Sp. nov.

A. superne rufescenti-suscus, aliquando griseo-lavatus, subtus pallidior, cauda pedibusque cum dorso concoloribus, cauda fere 7 corporis cum capite æquante; auriculis brevibus, vellere contectis, pilis longiusculis extus munitis; unguibus longis, albidis compressis, pilis haud obtectis; pollice brevi, unguifero; dente molario inferiore antico angulis 4 externis, 5 internis, spatiis in corona 7 munito, secondo tertioque singulis angulis utrinque tribus, totidem spatiis; dente superiore primo spatiis 5, angulis utrinque tribus, secundo spatiis 4, angulis tribus externis, duobus internis, tertio denique angulis tribus, quorum ultimus rotundatus, externis, duobus internis, in lobum elongato-ovatum postice productum desinente notando. Long. corporis cum capite 0·12 met., caudæ 0·032, auris 0·07, pedis posterioris a

HAB. Ad Mari (Murree) in montibus Himalayanis occidentalibus, ad latus occidentale fluminis Jhelum.

General colour above dark rich brown with a slight greyish tint, head rufescent, lower parts pale brown, tail the same colour as the back, feet covered with brown hair above, soles pale. Fur very soft, dark leaden grey at the base and for about \(\frac{1}{2}\) the length, tips dark rufous brown on the back, dirty white below. Ears short and rounded, concealed beneath the fur, thinly clad with long hair outside and with short brown hair inside near the border; a tuft of long hair on the anterior edge of the inner surface. Tail between \(\frac{1}{3}\) and \(\frac{1}{4}\) the length of the head and body, cylindrical, clothed with long hair at the base and with short brown hairs throughout the terminal three quarters of it length. Claws long, compressed, white, not concealed by long hairs, thumb small with a short compressed claw. The under side of the tarsus is hairy.

The following are the dimensions, in inches, of two specimens, both adult males, in spirit:—

	1	2
Length of head and body from nose to anus,	4.75	3.2
Ditto tail from anus (hairs at end not included),	1.35	$1\cdot 2$
Height of ear from orifice,	0.25	0.26
Breadth of ditto,	0.25	0.26
Length of fore-foot without claws,	0.4	0.4
Ditto of hind-foot and tarsus without claws,	0.7	0.7
Ditto of claw of middle toe,	0.11	0.13

The incisors are deep orange. The following are the characters of the molars:—

Described from two specimens in spirit and two skins sent by Mr. A. B. Wynne, of the Geological Survey. I have called the species after the discoverer, by whom I am informed that the native name is 'Kanis.'

I hope to give a fuller description of this and the other Himalayan forms shortly.

XXIII.—Some new Species of Rhopalocerous Lepidopters from the Indian Region.—By Captain G. F. L. Marshall, R. E., and Lional de Nice'ville.

(Received December 27th, 1880.)

- 1. EUPLŒA (SALPINX) ADAMSONI, Marshall.
- 3. Allied to E. superba, Herbst, but differing on the UPPERSIDE of the forewing in that the brilliant blue gloss is confined to the basal two-thirds not reaching to the costa or the inner margin, and that the spots are reduced to four in number all very small, one subcostal above the end of the cell, and one in the cell at the end both lilac, and two near anal angle, one marginal and the other submarginal, white. Hindwing as in E. superba.

HAB. Moulmein; taken in the autumn by Captain C. H. E. Adam-

- 2. ZOPHOESSA JALAUBIDA, de N.
- 3. Nearest to Z. atkinsonia, Hewitson; from which it differs on the UPPERSIDE in being deep brown instead of tawny and in having the macular bands and bar in the cell of the forewing ochreous. On the UNDERSIDE the ground colour is also deep brown, and the hindwing is crossed by several silvery white streaks on the basal half.

HAB. Jalauri pass, N. W. Himalayas.

- 8. LETHE MAITRYA, de N.
- 3. Allied to Lethe sidonis, Hewitson, from which it differs on the UPPER-SIDE in having an obscure ochreous band across the forewing beyond the

cell, and on the UNDERSIDE in the band in the cell, as also the band beyond the cell, of the *forewing* being very prominent, both of which bands are ochreous instead of silvery white.

HAB. Jalauri pass, N. W. Himalayas.

4. LETHE SIDEREA, Marshall.

\$\delta\$. Allied to \$L\$ sidonis\$, but differs in being smaller, in the uniform spotless upper surface, and the uniform paler brown ground-colour of the underside. Forewing entirely wanting the discal bands and the whitish spots on the costal margin; the only markings being three minute submarginal white spots beyond the cell (the middle one faintly circled with black), a single yellowish marginal line edged on both sides with dark brown, and within this a distinct silvery lilac submarginal line extending from the apex to the second median nervule. Hindwing with all the silvery streaks brighter and more distinctly lilac; the ocelli all blacker and less prominently pupilled with white; the second and third ocelli from the apex out of line, much nearer the margin, the silvery band within following this curve and deeply sinuated beyond the cell.

HAB. Sikkim.

5. LETHE SATYAVATI, de N.

Q. Similar in outline to L. latiaris Q and differing from it on the UPPERSIDE only in the absence of the transverse oblique ochreous line and the subcostal spot near apex of forewing. UNDERSIDE pale brown with no ochreous tint, and washed with lilac, especially on the outer half: both wings crossed by a prominent brown nearly straight subbasal line outwardly margined with lilac. Forewing with an irregular discal transverse brown line; a bar in the cell within the subbasal line; five indistinct submarginal ocelli circled with lilac and brown on a lilac ground; and a yellowish marginal line edged on both sides with dusky, within which a a brown band on the lilac ground between the ocelli and the margin. Hindwing with a discal very much angled dark brown line, within which is a very distinct lilac litura above the third median nervule; the submarginal ocelli large, the upper one distinctly pupilled with white and all of them profusely speckled with white; the usual marginal markings.

HAB. Sibsagar, Assam (S. E. Peal).

6. NEOPE BHIMA, Marshall.

3. Allied to N. moorei, Butler. Upperside: hindwing with only six oval black submarginal spots circled with yellow, the first minute, the rest large, prominent; two swarthy submarginal lines and the margin itself swarthy. Underside: the basal area of both wings pale olivaceous brown, irro-

rated and irregularly streaked and spotted with dark brown, with a few ochreous spots and streaks. A nearly straight band of pale ochreous across both wings beyond the middle bordered interiorly with dark brown most broadly on the forewing. Forewing with a row of five oval black spots pupilled with white and banded with yellow, the third and fourth much larger, placed on a broad discal brown band; a pale ochreous submarginal band beyond uniting at the anal angle with the pale ochreous median band, the margin and two submarginal lines swarthy on a vellow-brown ground. Hindwing with a sinuous band of eight perfect ocelli, the seventh and eighth with yellow irides coalescing.

HAB. Burmah; taken in April in the upper Thoungyeen forests, Tenasserim, by Captain C. T. Bingham.

EREBIA SHALLADA, Lang.

3. 2. Allied to E. kalinda but rather larger, and the male broaderwinged than in the species mentioned; darker and less brightly coloured. UPPERSIDE with a small, diffused, dark ferruginous patch within the middle of exterior margin on both wings, smaller than in E. kalinda on the forewing, and larger on the hindwing.

HAB. Kunawar. This species was discriminated by Col. A. M. Lang, R. E, some years ago, but no description has hitherto been published.

EREBIA MANI, de N.

3. 2. Allied to E. kalinda, Moore, from Kulu specimens of which species it differs on the UPPERSIDE in the larger extent and lighter and vellower colour of the patch on the forewing; and in the entire absence of the ferruginous patch on the hindwing: and on the UNDERSIDE by having the vellowish patch on the forewing as on the upperside and abruptly defined.

HAB. Chung pass and Lingti, Ladak.

MYCALESIS OCULUS, Marshall.

3. 2. Allied to M. onatus, Hewitson. UPPERSIDE: forewing with the lower ocellus considerably larger, and broadly surrounded with ferruginous vellow; the vellow almost reaching the inner margin and connected by a band of the same colour with the costa: hindwing with four increasing black ocelli white-pupilled and with yellow rings, the yellow rings coalescing. UNDERSIDE with a yellow discal band crossing both wings, prominent in the female, obsolete except near the costa in the male.

HAB. Travancore; taken in May in the Ashamboo hills by Mr. Harold S. Fergusson.

10. LIBYTHEA BOHINI, Marshall.

2. UPPERSIDE brown with pure white markings. Foreving with an oval spot filling the end of the cell, a large quadrate spot on the disc between the first and second median nervules, two spots coalescing one on each side of the upper discoidal nervule, and a spot near the costa divided into three by the subcostal nervules. Hindwing with a large square spot on the costa, a straight median band across the wing below the cell not reaching the inner or outer margins and cut by the discoidal and three median nervules, and a small spot above between the subcostal nervules. All the spots and bands pure white.

HAB. Khasi hills; taken near Shillong in May by Mr. J. P. Cock.

With the exception of *Euplæa adamsoni*, *Lethe siderea*, and *L. satyavati*, all the species above characterised will be figured in the descriptive hand-book of the butterflies of the Indian region which we shall shortly publish under the title of 'The Butterflies of India, Burmah, and Ceylon'; and in which fuller detailed descriptions of all will be found.

XXIV.—Description of Parantirrhoea Marshalli, the Type of a new Genus and Species of Rhopalocerous Lepidoptera from South India.—
By J. WOOD-MASON, Deputy Superintendent, Indian Museum, Calcutta.

Family NYMPHALIDÆ. Subfamily SATYRINÆ.

Parantirrhoea,* n. gen.

d. Anterior wings triangular; anterior margin moderately and regularly arched; apical angle acute; outer margin almost straight, being only just perceptibly convex; inner angle rounded; inner margin sinuous, being lobed at the base much as in the males of *Olerome* and *Minona*, genera of Morphina; subcostal vein 4-branched, the first branch given off before, and the second beyond, the end of the discoidal cell, the first, second, and third coalescing successively and respectively with the costal vein, the first, and the second, and all three in turn becoming free and running off at a tangent, like the costal vein, to the anterior margin, the fourth being perfectly free from its origin and running to the apical angle; posterior discocellular veinlet long, very slightly concave outwards, almost straight, intermediate one not quite half the length of the posterior, ante-

^{*} From mapa, by the side of, and Antirrhosa, generic name.

rior one rudimentary; submedian vein sinuous, short, terminating in the wing membrane near the inner margin at about the level of the junction of the basal and second fourth of the length of that margin, being, in fact, hardly more developed than is the internal vein of the Papilioning as compared with that of many Heterocerous Lepidoptera; the first median veinlet directed straight outwards and backwards, out of its normal course, to the inner angle and supplying the place of the rudimentary submedian; on turning to the underside, it is seen that a narrow rounded lobe of the functional sutural area about six times as long as it is broad is folded back upon the under surface, to which it is firmly adherent; this lobe occupies the middle two-fourths of the length of the inner margin, and is thickly clothed on its surface and fringed at its free edge with firmly attached, long, and somewhat raised modified scales rendered conspicuous by their rich dark brown colour and satiny lustre; the outline of this turned up lobe is marked out on the upperside by a curvilinear groove.

Posterior wings tailed, subquadrate, with four distinct margins, viz., a strongly and irregularly arched anterior margin, nearly straight external and posterior margins, and an inner or abdominal margin, marked out by the obtuse-angled apex, the tail, and the well-rounded anal angle; with a black oval sexual mark, divided by the submedian vein, near the anal angle; costal vein short and straight, terminating before, and the first branch of the subcostal which originates close to the base of its vein ending beyond, the middle of the length of the anterior margin, the second branch being given off before the middle of the discoidal cell and extending into the apical angle; 'discoidal' vein in the same straight or slightly curved line with the subcostal; discocellalar veinlet sinuous; the third median veinlet produced to a conspicuous tail.

Antennæ fine and distinctly clubbed.

Female unknown.

No Asiatic genus of SATTRINE presents us with any approach to the remarkable arrangement of the two hindermost veins of the anterior wings described above; but, in the South American genus Antirrhoea, we meet with identically the same arrangement, the first median veinlet in A. archaea and its congeners running back to the inner angle and the submedian vein ending a considerable distance short of that angle, though not nearly so far short of it as in the Indian form, for which I propose the above name in allusion to these remarkable points of resemblance, reserving all further comparisons and comment until I shall be in possession of specimens of the South American forms.

P. marshalli, n. sp.

3. Wings above dark fuscous suffused with rich deep violet.

Anterior wings with an outwardly and forwardly arched subcrescentic pale violet or mauve band commencing beyond the middle of the wings at the costal vein, terminating at the inner angle, and crossed obliquely by a series of three small white spots disposed in a straight line parallel to the outer margin and placed upon folds of as many consecutive cells, the last being between the two anterior median veinlets.

Posterior wings relatively longer-tailed than in *Melanitis ismene* (Cramer) with the membranous parts of the divergent tails almost wholly formed by the produced wing-membrane of the interspace between the second and third median veinlets, a very narrow anterior membranous edging only being contributed by the interspace next in front; and with rather more than the basal two-thirds of their length in front of the discoidal and subcostal veins ochreous.

Wings below ochreous obscurely striated with a deeper shade of the same colour, and marked with a submarginal series of inconspicuous brown specks, the probable rudiments of ocelli.

Length of anterior wing 1.16; whence expanse = 2.4 inches.

The female will, in all probability, prove to differ from the male not only in the absence of the sexual spot in the posterior wings, but also in having the inner margin of the anterior wings straight and neither lobed at the base nor turned up in the middle, and the first median veinlet and the submedian vein of the same wings normally arranged and developed and directed respectively to the outer margin and to the inner angle after the manner usual amongst butterflies.

HAB. Trevandrum, Travancore, South India. Described from four specimens of the male, one, the type, recently purchased by the Indian Museum, and three belonging to Captain G. F. L. Marshall, R. E., to whom I am indebted not only for the opportunity of describing this interesting insect, but also for permission to dissect one of the specimens in his collection.

P. S.—The species of the genus *Elymnias* alone present the same disposition of the three anterior veins of the posterior wings.

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Names of new Genera or new species have an asterisk (*) prefixed.

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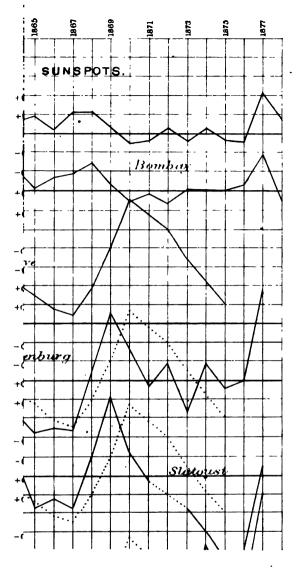
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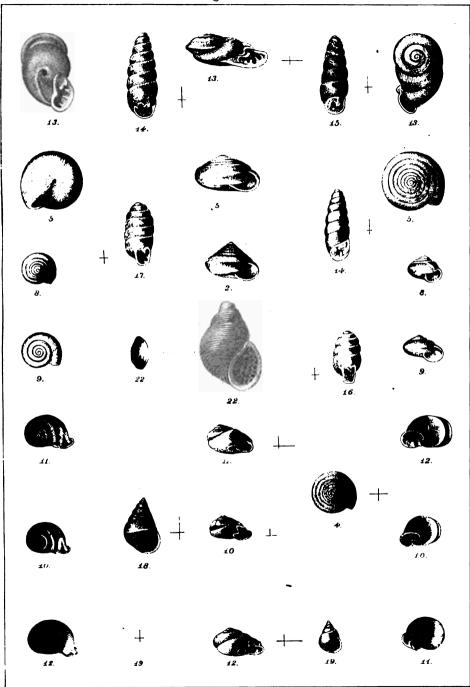
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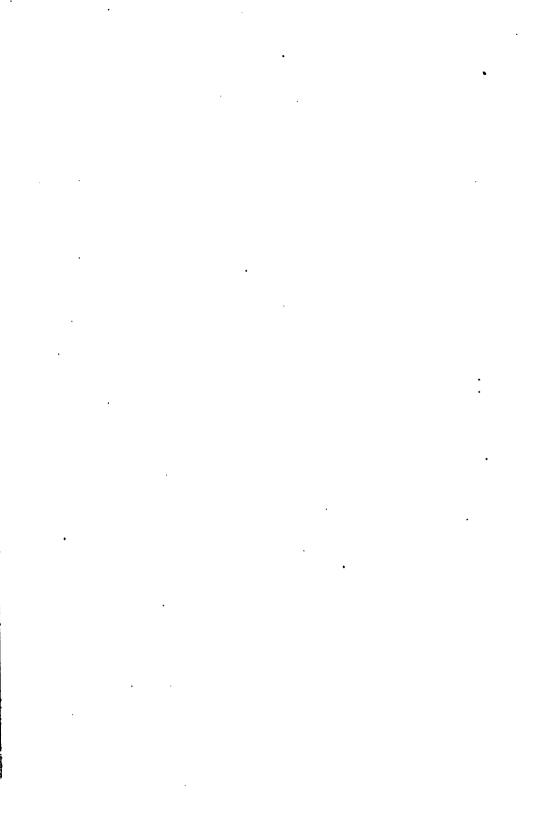


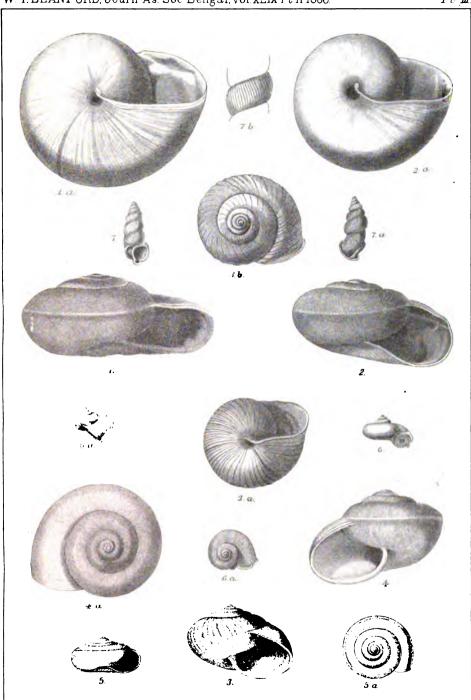
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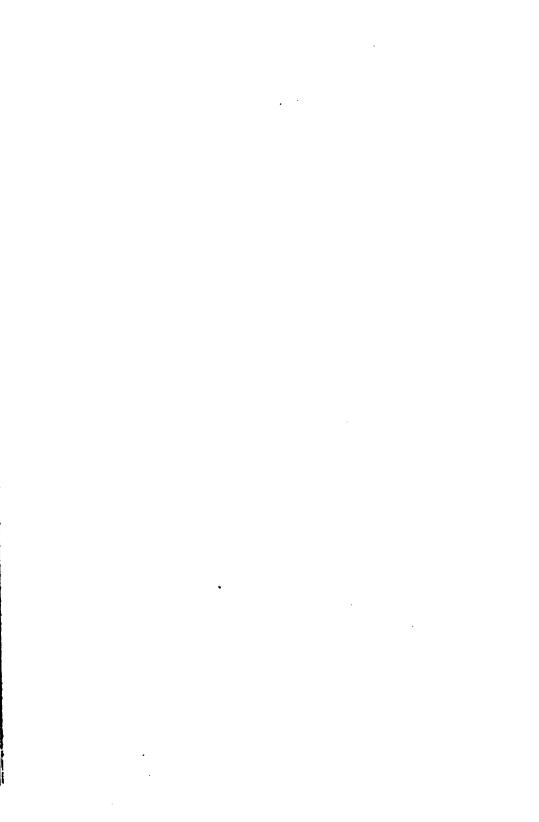


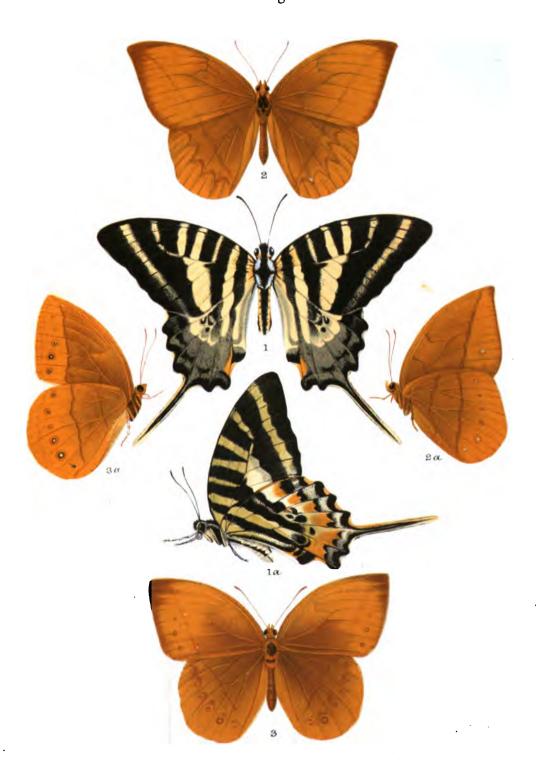


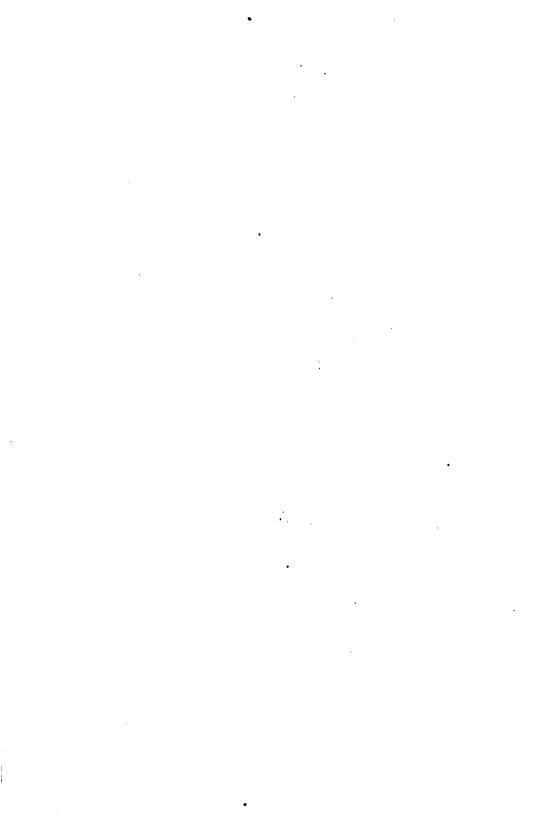


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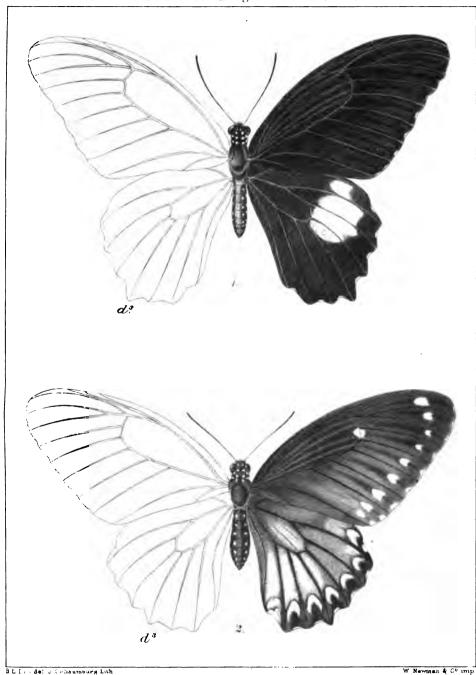






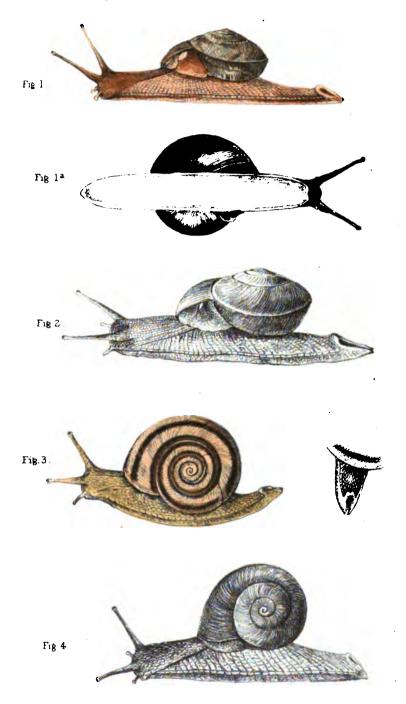
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2. PAPILIO GASTOR, \$





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INDIAN ARIOPHANTA.



INDIAN HEMIPLECTA.

Fig.4.

Plate X



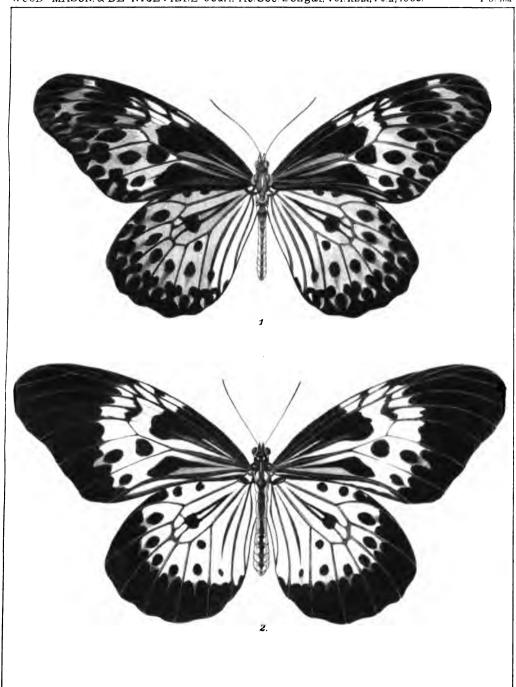


Fig 1 HESTIA CADELLI, d. Fig 2 HESTIA HADENI, 9

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